N5 Physics Revision

Past paper selector

Questions on required **experiments** (descriptions and improvements)

Questions that require **explanations**

Suggestions for **Open Ended Questions**

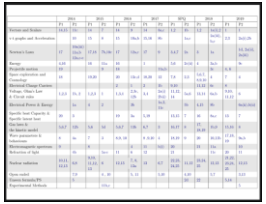
Questions that require **drawing graphs**

Questions on **unfamiliar Physics**

Questions that require **drawing sketches**

←

Descriptions of Experiments



1. Read experiment summary document *(opens in external tab)*
2. Complete past paper questions as follows.

Average and instantaneous speed	**2024** MC Q2, **2023** MC Q2, **2018** Q2ai
Acceleration	**2020** 2a, **2015** Q8ai
Half-life	**2024** MC Q25, **2023** Q14ai, **2020** Q12biii, **2019** Q12a, **2018** Q13ai, **2014** Q6bi
Ohm’s Law	**2024** Q8aiii, **2016** Q2b
Gas laws	**2022** Q9a, **2018** Q9ai, **SPQ** Q8a,8d
Specific heat capacity	**2014** Q3, **2017** MC Q5, **2018** Q8a, **2023** MC Q16, **2024** MC Q15
Specific latent heat	**2018** Q8c
Improvement to experiments	**2014** 3c, **2015** 11b, **2016** 6c, **2017** 4aii, **2018** 8aii, **2018** 9b, **2018** 13ci, **2019** 5aiv, **2019** 12b, **2020** 11ciii, **2022** 2aiii, **2022** 9c, **2023** 7b, **2024** 11bii

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Explanation Questions topic selection

Dynamics

Properties of matter

Electricity

Space

Radioactivity

Waves

←

Common Explanation Questions

Dynamics

Vectors and scalars	**2016** 9bii, **2023** 1bii
Free body diagrams and Newton's Laws	**2014** 10e, **2014** 12c, 12e, **2015** 7b, **2016** 10c, **2017** 9a, **SPQ** 1cii, **SPQ** 2ci, **2019** 1d, **2023** 2ci
Energy conservation	**2018** 3bii, **2019** 9cii, **2020** 3bii, **2023** 1ciii
Projectile motion	**2017** Q11bi, **Sketch questions: 2015** Q9a, **2018** Q3c, **2023** Q2a, **2024** Q3b

Common Explanation Questions

Electricity

AC/DC	**2017** 1b, **2024** 7a
Switches	**2014** 1bii, **2015** 1c, **2020** 6b, **2023** 6bii
Resistors	**2019** 5b, **2020** 6ai, **2022** 6cii,
NPN and MOSFET (transistors)	**2014 2bi,** **2014** 2bii, **2016** 3c, **SPQ** 6a, **2020** 7bi, **2022** 7c, **2024** 7c
Power	**2017** 2bii, **SPQ** 5b, **2019** 6bii,

←

Common Explanation Questions

☢️ Radioactivity ☢️

Nature of radiation, ionisation and activity	**2016** Q7c, **SPQ** 12c, **2019** 12d, **2022** 13a,bii, **2023 13a**, **2023 13b**
Dosimetry equations	
Half life	**SPQ** 11b, **2018** 12b
Fission and fusion	**2016** 13a, **2017 Q7b**, **2020** 13a, **2022** 14bii, **2024** 15b,c,d

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Common Explanation Questions

🌡️ Properties of matter 🌡️

Specific heat capacity and specific latent heat	**2016** 3bii, **SPQ** Q7cii, **2018** Q8aii, **2019** Q7biii, **2020** Q8c. **2022** 8bii, **2023** 8aii,8b, **2024** 9bii
Gas laws and the kinetic model	**2017** Q3b, **SPQ** Q8aii,8c, **2018** 1b, **2018** 9aii, **2019** 8cii, **2020** 9bii, **2022** 9d, **2023** 9aiii, **2024** 10aii

←

Common Explanation Questions

Space

Space and Cosmology	**2016** Q12b, **2016** Q13d, **SPQ** Q2b,c, **SPQ** Q2d, **2018** Q4b**,** **2019** Q4b,c **2020** 4c,dii, **2022** 3b, **2022** Q5b, **2022** Q5c, **2023** Q3a, **2024** Q4b, **2024** Q4c, **2024** Q15a

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Common Explanation Questions

Waves

Wave parameters & behaviours	**2015** 3d, **2019** 9b, **2023** 10bii, **2024** 12c
Diffraction	**2017** 4d, **2023** 11b,
Refraction	**2018** 11cii, **2019** 11b, **2024** 12bi,

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Open Ended Questions

Vaguely categorised!

Dynamics	2016 Q11
Electricity	2018 Q7, 2020 Q10
Radioactivity	2017 Q5, 2019 Q13, 2024 Q13
Properties of matter	2015 Q4, 2017 Q10, 2022 Q12b
Space	2014 Q9, 2015 Q10, SQP Q4, 2018 Q5, 2019 Q3, 2020 Q5, 2022 Q4, 2023 Q4, 2024 Q5
Waves	2014 Q7, 2016 Q5, 2023 Q12

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Graph drawing

Dynamics	SQP Q8a, 2015 Q11b, 2022 Q2a
Electricity	2019 Q5a, 2023 Q7a, 2024 Q8a
Radioactivity	2018 Q13b
Properties of matter	
Space	
Waves	2020 Q11c

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Unfamiliar Physics

Dynamics	**SQP** Q2d, **2018** Q22, **2020** Q4, **2024** Q18
Electricity	
Radioactivity	
Properties of matter	**2019** Q14, **2021** Q18
Space	**2023** Q6
Waves	**2014** Q5

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Drawing questions

Dynamics	**Velocity time graphs** **2018** Q2c **2023** Q2bii	**Free body diagrams** **2015** Q7b **2016** Q10c **2019** Q8a **2022** Q3(ii)	**Projectiles** **2015** Q9a **2018** Q3c **2023** Q2a **2024** Q3b
Electricity	**Circuit diagram** **2015** Q1a **2016** 2a	**Transistor circuit** **2022** Q7c(i)	**Voltage current graph** **2024** Q8b (V-I graph)
Properties of matter	**2017** Q3c (pV graph)	**2022** Q12a(ii) (Leslie's cube)	
Waves	**Refraction** **2014** Q4b (water) **2019** Q11ai (prism) **2022** Q11a (semicircular)	**Normal and angles** **2015** Q5a (i and r) **2016** 6a (normal, i,r) **2018** 11c (normal, i,r)	**Diffraction & waves** **2017** Q4c (gap) **2020** Q11a (wave) **2022** Q10b (obstacle) **2024** Q11d (obstacle)

N5 Physics Revision

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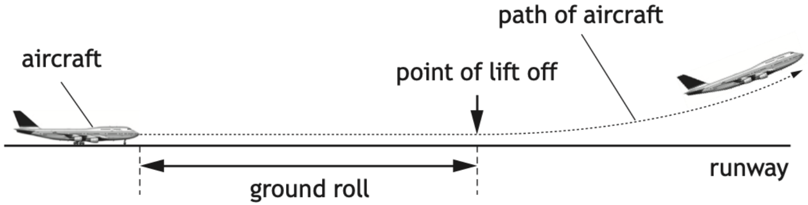
Dynamics

2016 Q11

The length of runway required for aircraft to lift off the ground into the air is known as the ground roll.



The ground roll of an aircraft varies for each take-off.

Use your knowledge of physics to comment on why the ground roll of an aircraft varies for each take-off.

This is quite a hard Open Ended Question!

Good answers relate to what affects the ground roll. Lift (the upward force) is provided by the wings - this lift must be greater than the weight (so a free body diagram might be good to include) for the plane to take off. The lift force is dependent on the speed of the air flow over the wings…so what would affect the speed of the aircraft?

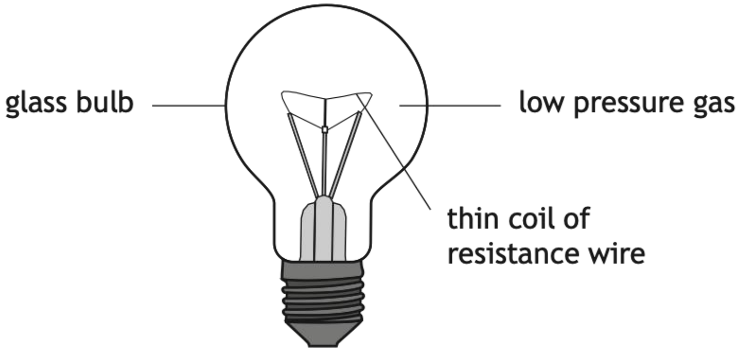
Speed is dependent on the acceleration, which is given by a = F/m. The thrust of the engines provides the forward force, so a bigger more powerful engine would provide more thrust. However bigger engines and bigger planes have more mass, so the acceleration may consequently be reduced. If there is a wind acting against or in the same direction the plane is moving this would also affect the unbalanced force. And air resistance will increase as the plane gets faster, so acceleration may reduce as it speeds up.

Ultimately the rate of acceleration determines how long the ground roll needs to be.

Electricity

2018 Q7

A filament lamp consists of a thin coil of resistance wire surrounded by a low pressure gas, enclosed in a glass bulb.



Using your knowledge of physics, comment on the suitability of this design as a light source.

Two main things to consider here.

The thin coil of resistance wire. This gives you the opportunity to show off your understanding of resistance, voltage and current. What happens to the electrons as they flow through this thin wire…what causes it to glow? Why is a thin wire used and not a thick wire? Is it important that it is in a coil? Discussions about ohmic vs non-ohmic resistors would be appropriate here too.

The low pressure gas - why is a low pressure gas used? Are there considerations to Gay-Lussac's law? Could you describe what happens to a gas and its pressure when the gas is heated, as will inevitably happen when the bulb is lit? Does this give a reason why a low pressure gas is used? Also why is a gas in there at all…why not have no gas in the bulb?

Electricity

2020 Q10

Electric vehicles are being promoted as an environmentally friendly method of transport.

Currently one of the limitations of electric vehicles is their range. The range is the maximum distance that an electric vehicle can travel before its batteries need to be recharged.

Using your knowledge of physics comment on possible factors affecting the range of an electric vehicle.

Physics points to consider:

E_w = Fd. The energy stored in the battery causes a force to be applied over a certain distance. Moving an electric car requires a large amount of force, as they are heavy, so for them to accelerate, since a = F/m, a larger force is required for a larger mass to provide the same rate of acceleration.

Knowing the force the engine exerts on the car would allow you to determine the distance the car can travel, assuming we know the energy the battery stores.

However, some energy is always lost as heat. This relates to the efficiency of the engine. If more energy is lost as heat, less is available to drive the wheels, which will reduce the distance the car can travel.

Range can also be affected by air resistance - the faster you travel, the greater the air resistance and the greater effect this will have on how far you can travel.

Temperature also affects the efficiency of batteries, so range is lower in the colder months.

Radioactivity

2017 Q5

Alpha, beta and gamma are types of nuclear radiation, which have a range of properties and effects.

Using your knowledge of physics, comment on the similarities and/or differences between these types of nuclear radiation.

This is an opportunity to state just what the question is looking for….properties of alpha, beta and gamma….

- range of travel
- penetration ability and what materials absorb them
- ionising ability and radiation weighting factor
- composition (what are they made of)
- uses/applications of each kind of radiation

This is a fairly easy OEQ to get good marks.

Radioactivity

2019 Q13

A physics teacher makes the following statement.

‘Instead of nuclear fission, perhaps one day nuclear fusion will become a practical source of generating energy.’

Using your knowledge of physics, comment on the similarities and/or differences between using nuclear fission and nuclear fusion to generate energy.

Key things to communicate:

Nuclear fission is splitting the nucleus of the large unstable atom
Nuclear fusion is joining small nuclei together to form larger nuclei.

Both processes result in the release of energy.

Nuclear fission has products which have long half-lives and therefore remain radioactive for a long time. This is known as nuclear waste and creates a storage problem for generations to come.

Nuclear fission however is well understood and currently is sustainable using controlled chain reactions in nuclear reactors - it is a viable method for generating electricity that does not result in emission of CO_2 in the generation process.

Fusion however is not currently viable. Discussions about the challenges of fusion, namely the large amount of heat energy required to produce plasma, and then the requirement to contain this plasma using magnetic fields so that the nuclei can fuse together, should be included.

Radioactivity

2024 Q13

Two students are discussing radiation.

The first student states: *'All radiation is dangerous, so we should never allow ourselves to be exposed to it.'*

The second student states: *'No, it's only nuclear radiation that we need to worry about.'*

Using your knowledge of physics, comment on the students' statements.

Physics to consider:

This question primarily relates to the difference between ionising and non-ionising radiation. Nuclear radiation, i.e., radiation emitted from the nucleus of the atom, is ionising (alpha, beta and gamma). These types of radiation can ionise the atoms in our body, changing the chemical structure and potentially causing cells to mutate.

Non-ionising radiation, for example radio waves, microwaves and infrared have different sources, and are considered safer. However microwaves emitted from a microwave oven high intensity, and can heat molecules of water.

Since our body is made of water exposing ourselves to the amount of power generated by a microwave oven would be dangerous, however low intensity microwaves from mobile phones and wifi routers are not dangerous.

Same can be said for infrared. It is not dangerous, but from high power sources the amount of IR could burn our skin.

Properties of matter

2015 Q4

A science technician removes two metal blocks from an oven. Immediately after the blocks are removed from the oven the technician measures the temperature of each block, using an infrared thermometer. The temperature of each block is **230 ºC**.

After several minutes the temperature of each block is measured again. One block is now at a temperature of **123 ºC** and the other block is at a temperature of **187 ºC**.

Using your knowledge of physics, comment on possible explanations for this difference in temperature.

The main focus of this question relates to specific heat capacity, but answers can include other reasons why one block cools much faster than the other.

Since, $\Delta T = E_h/mc$, the temperature drop is dependent on the rate of heat loss, the mass of the block and the specific heat capacity of the block.

Firstly, specific heat capacity. You could define this, and explain that the block that cools down quicker may have a lower specific heat capacity. This means it needs to lose less energy for the temperature to drop by 1 degree.

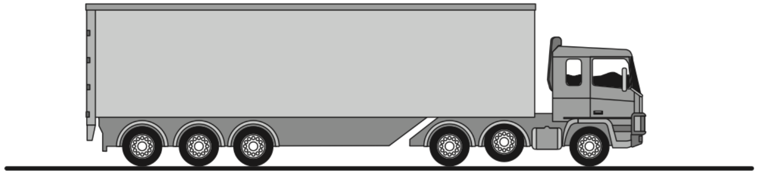
Other factors that would affect the temperature drop include the mass of the blocks (the smaller mass would fall in temperature faster (see equation $E_h = mc\Delta T$)), but also the rate of energy transfer due to the colour of block, what surface the block is placed on and the surrounding temperature would affect how quickly the block loses heat energy and therefore changes temperature.

Properties of matter

2017 Q10

An articulated lorry has six pairs of wheels.

One pair of wheels can be raised off the ground.



Using your knowledge of physics, comment on situations in which the wheels may be raised or lowered.

Key areas to consider:

Why would lorry need to lower its wheels…?

To add more friction when it is slippy. You could discuss causes of reduced friction on road…gravel, moisture, ice etc. and explain what friction is.

When the lorry carries more load so there is more weight (explain how weight relates to mass) - this leads to ideas about pressure…

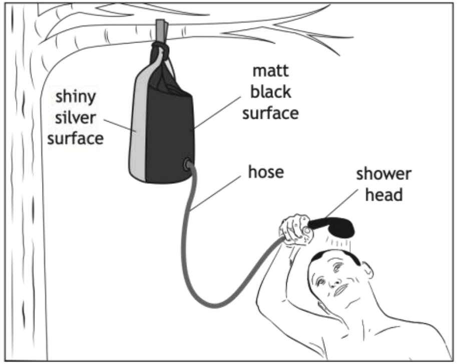
Pressure is force per unit area. If the weight is greater, the downward force is greater therefore the pressure would increase (as pressure = force/area).

To reduce this pressure, wheels would be lowered to increase surface area. This is important when the lorry is travelling over soft ground, were the large pressure could cause the lorry to get stuck.

Properties of matter

2022 Q12b

A solar shower consists of a heavy-duty plastic bag, with a matt black surface and a shiny silver surface, connected to a hose and shower head. The bag uses infrared radiation from the Sun to heat water for a shower, when camping.



Using your knowledge of physics, comment on how the solar shower works.

Physics to focus on:

Black colours absorb heat, whereas shiny surfaces reflect heat - and how this is utilised to make the shower bag.

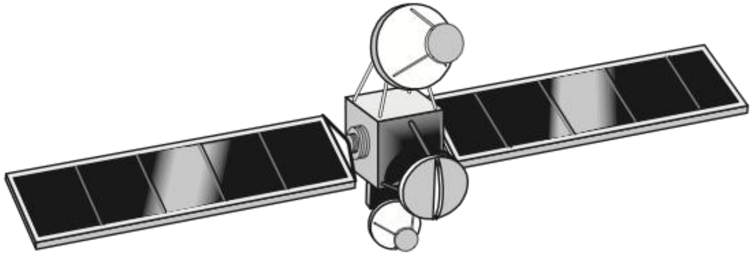
Pressure changes of water in bag as liquid gets heated by sun.

Gravitational potential energy stored in the water converted to kinetic energy as it falls through the shower head.

Space

2014 Q9

A communications satellite is used to transmit live television broadcasts from the UK to Canada.



A student states that, to allow the live television broadcasts to be received in Canada, it is important that the satellite does not move.

Use your knowledge of physics to comment on this statement.

The premise of this question relates to a misunderstanding of the term geostationary satellite.

Define what a geostationary satellite is and state that for communication between UK and Canada via satellites the satellite needs to stay at the same location above the earth's surface. A drawing would help with this.

Ground based transmitters (also likely to be satellite transmitters - you could explain how curved reflectors work) can send microwave signals to the fixed location in the sky where the satellite is, and this signal can then be amplified and relayed to the ground receiver in the other country.

However it is important to state clearly that a geostationary satellite is moving - it acts like a projectile with a horizontal velocity and a vertical acceleration, as it orbits the earth. It's just that the earth spins on its own axis with the same period.

Could also discuss speed of signal and give examples of speed, distance and time calculations.

Space

2015 Q10

Space exploration involves placing astronauts in difficult environments.

Despite this, many people believe the benefits of space exploration outweigh the risks.

Using your knowledge of physics, comment on the benefits and/or risks of space exploration.

This question links directly to learning intentions in the course spec document:

Awareness of the challenges of space travel:

travelling large distances with the possible solution of attaining high velocity by using ion drive (producing a small unbalanced force over an extended period of time)
travelling large distances using a ‘catapult’ from a fast moving asteroid, moon or planet

manoeuvring a spacecraft in a zero friction environment, possibly to dock with the ISS

maintaining sufficient energy to operate life support systems in a spacecraft, with the possible solution of using solar cells with area that varies with distance from the Sun

Awareness of the risks associated with manned space exploration:
fuel load on take-off
potential exposure to radiation
pressure differential
re-entry through an atmosphere

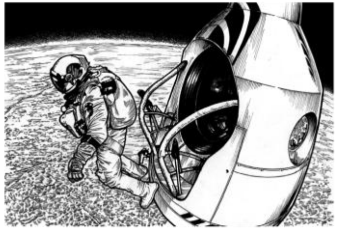
Space

SQP Q4

In October 2012, a skydiver jumped from a balloon at a height of **39 km** above the surface of the Earth.

He became the first person to jump from this height.

He also became the first human to fall at speeds higher than the speed of sound in air.



Using your knowledge of physics, comment on the challenges faced by the skydiver when making this jump.

Points to consider relating to challenges:

Low air pressure in upper atmosphere causing breathing difficulties.
(not really significant but increased exposure to cosmic rays at these heights increases risk due to biological effects of nuclear radiation).

Extreme cold, as air traps heat from the sun, so low air pressure means very cold conditions.

Rate of acceleration is very high (equivalent to g due to lack of air resistance, resulting in rapid speed increase, as skydiver starts to travel through thicker atmosphere, greater air resistance produces heat (like shuttle re-entering atmosphere, risk of heat causing material to catch fire, or harm diver). This heat is caused by friction - can you explain how friction generates heat?

Challenges of deceleration - knowing when to deploy parachute so that diver comes to a suitable landing speed in time (as more time is required to decelerate from this high speed).

Space

2018 Q5

A group of students are watching a video clip of astronauts on board the International Space Station (ISS) as it orbits the Earth.

One student states, ‘I would love to be weightless and float like the astronauts do on the ISS.’

Using your knowledge of physics, comment on the statement made by the student.

The key idea here is that the astronauts only *appear* to be weightless. The gravitational field strength where the ISS orbits is not that much less than on the surface of the Earth. To say that there is no gravity in space is a big error of understanding.

The ISS orbits because it is pulled to the earth due to gravity. Therefore everything and everyone inside it are also orbiting and being pulled to the Earth.

The difference is it also has a horizontal velocity (like a projectile) so it is falling toward Earth but never hit it. The Newton’s cannon ‘thought experiment’ could be describe here. Compare the motion of the ISS to a projectile.

Space

2019 Q3

In 1971, the astronaut Alan Shepard hit a golf ball on the surface of the Moon.

Using your knowledge of physics, comment on the similarities and/or differences between this event and hitting an identical ball on the surface of the Earth.

Points to consider:

Gravitational field strength on the moon is lower. This means that when the projectile is launched (hit by the club) it will travel higher as the rate of deceleration is lower (remember, gravitational field strength is equivalent to acceleration due to gravity). This also means it will travel farther horizontally as it will take longer to fall to the ground from a higher height.

Air resistance. There is no atmosphere on the moon, so there is no air resistance. With projectile motion on the earth, we assume the horizontal velocity is constant as there are no forces acting horizontally. In reality air resistance slows down the horizontal velocity. On the moon this would not happen and the horizontal velocity would actually be truly constant.

Also, the vertical acceleration of a golf ball on the Earth would be constantly changing, as when it travels upward and slows down, the air resistance would get less. However on the moon the vertical acceleration is not changing.

Space

2020 Q5

The Andromeda Galaxy is more than 2 million light-years from Earth and is visible with the naked eye. However, there are many astronomical objects that are not visible with the naked eye.

Andromeda Galaxy

Using your knowledge of physics, comment on how astronomers obtain information about astronomical objects.

Some ideas to consider:

Physical exploration - sending robots and people to different astronomical objects - could discuss the risks and benefits of manned space exploration.

Observation using telescopes

The light from stars and galaxies contains information about the chemical composition of stars. Could explain how line spectral information from starlight is used to determine the chemical makeup of the atmosphere of stars (and also exoplanets).

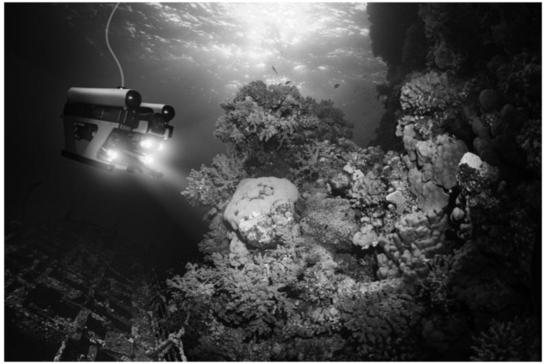
Information from different parts of the EM spectrum - each part of the EM spectrum tells information about the makeup of stellar objects - see this NASA link (opens in new tab) for more information.

Doppler effect - the redshift of light from galaxies tells us that the universe is expanding.

Space

2022 Q4

Space exploration is often in the news, yet we have only explored about 5% of the oceans on Earth.



Using your knowledge of physics, comment on the similarities and/or differences between space exploration and underwater exploration.

Difficult question

Focus on the risks of space exploration content (see 2015 Q10) and compare that with issues with water pressure at depth, and how increased water pressure has an effect of reducing the volume of air - this can cause risks for divers.

Light penetration through water is also a problem compared to the vacuum of space. However sound, in principle, can travel in water, whereas it cannot travel in a vacuum, unlike light.

Newton’s 3rd law - in space there is nothing to push off to move forward, and slowing down has challenges due to lack of friction and air resistance. Not so much of an issue under water. Indeed, there is a large amounts of drag due to water resistance.

Oxygen supplies are needed both in space and under water, but not much physics to say about that!

Space

2023 Q4

A space scientist makes the following statement.

‘Before we can have human space exploration of the solar system and beyond, we need to build a base on the Moon.’

Using your knowledge of physics, comment on the benefits and/or challenges of using a base on the Moon from which humans could explore the solar system and beyond.

Think about the risks and benefits of using the Moon as a base:

Risks - pressure differential - there is no atmosphere on the moon, so pressurised suits are needed all the time. An impact by a micro meteor could cause a leak which would put astronauts lives at risk.

Potential exposure to radiation - the moon does not have an atmosphere. This risks greater exposure to ionising cosmic rays from the Sun (explain ionisation). Also, the lack of atmosphere means meteors are not going to burn up like they would in Earth’s atmosphere due to friction turning the kinetic energy of the rocks into heat.

Maintaining life support - with no obvious fuel source solar panels would need to convert the Sun’s light energy into electrical energy.

Benefits - the Moon’s lower gravitational field would mean that less fuel and upward thrust would be required to accelerate off the surface, or with the same thrust greater accelerations would be possible as the unbalanced force would be greater (Since W = mg, lower weight due to lower g).

No atmosphere, so no air resistance on take off also means greater acceleration.

The lack of atmosphere would allow ground based telescopes on the moon to have a better view of space, as there would be no atmospheric distortion.

Space

2024 Q5

Around 500 years ago Nicolaus Copernicus, a Polish astronomer, proposed a model of the Universe with the Sun motionless at its centre and the stars fixed in position in the night sky.

Using your knowledge of physics, comment on this model.

Physics points to consider:

The Sun is not motionless. It rotates on its own axis, and it also orbits the galaxy. The galaxy, like other galaxies, is moving with the expansion of space.

The sun appears motionless relative to the earth. It is correct that the earth orbits the sun. However the Sun is not at the centre of the universe, rather it is at the centre of our solar system - an explanation of what the solar system is and how there are other star systems with exoplanets orbiting them could be part of your answer.

The stars in the night sky are also not fixed. They all rotate on their own axis, some orbit a fixed point with other stars (binary stars) and all stars also orbit the galaxy, which is believed to have a black hole at its centre.

You could comment how on a typical clear night the stars (and the moon) appear to move across the sky, but that is because the Earth is spinning on its own axis.

At different times of year we see different stars in the sky (and planets at different positions), because of Earth's relative position in its orbit around the Sun.

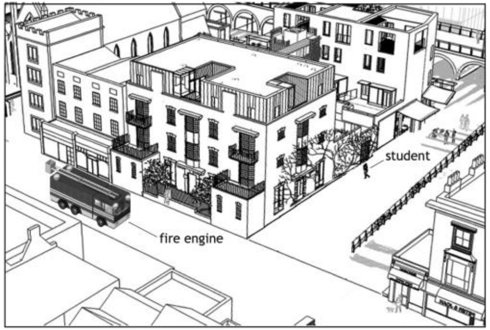
Waves

2014 Q7

A fire engine on its way to an emergency is travelling along a main street.

The siren on the fire engine is sounding.

A student standing in a nearby street cannot see the fire engine but can hear the siren.



Use your knowledge of physics to comment on why the student can hear the siren even though the fire engine is not in view.

Key Physics - light waves travel in straight lines but sound waves can diffract around corners.

This is because light waves have very small wavelength and so can only diffract through very small gaps, whereas sound waves have much longer wavelengths and so can diffract around much larger objects and gaps, hence travelling around the corner.

Sound waves are also more able to reflect off buildings, whereas light waves would need mirrors to reflect off buildings.

A convex mirror would allow light waves to reflect providing a large field of view.

This is a fairly hard question to get good marks.

Waves

2016 Q5

A Physics textbook contains the following statement.

"Electromagnetic waves can be sent out like ripples on a pond."

Using your knowledge of physics, comment on the similarities and/or differences between electromagnetic waves and the ripples on a pond.

Key areas of physics are EM waves and water waves.

Ripples on a pond are transverse waves…opportunity to define transverse waves and explain the properties of a transverse wave (amplitude, wavelength etc.) and also that waves need a medium to travel through.

EM waves are also transverse, but they do not require a medium to travel through - instead they permeate through space (which is a vacuum) as electric and magnetic fields oscillating like a transverse wave.

You could explain that EM waves also travel out in all directions from a source, just like throwing a stone into a pond to produce water waves. Also that EM waves behave like water waves in that they can reflect off objects and diffract as they travel through gaps, just like water waves do.

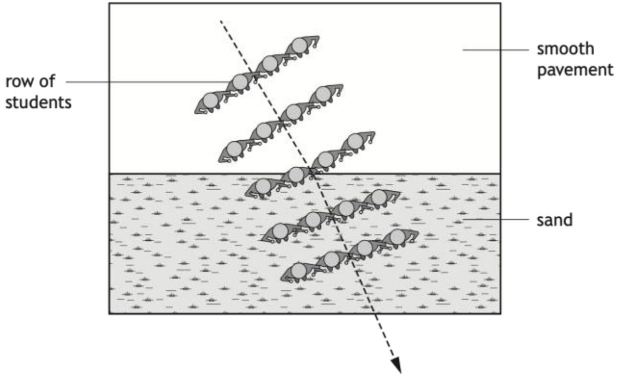
You could also describe the different types of EM waves, that the wavelength and frequency can vary just like water waves can dependent on the source producing the rippling in a pond.

Waves

2023 Q12

The use of analogies from everyday life can help improve the understanding of physics concepts.

Rows of students with arms linked together moving from a smooth pavement to sand can be used as an analogy for the refraction of light.



Using your knowledge of physics, comment on this analogy.

Physics to consider:

Define refraction - change of speed of light and wavelength of light (and direction if incident at a non-zero angle relative to the normal line) when light travels from one medium to another.

In the example we can clearly see a reduction of wavelength of the ‘wavefronts’ as the students move in the sand. This is because they have slowed down. Furthermore, the student on the left enter the sand first, so the ‘wavefront’ changes direction as those on the left slow before those on the right, causing them to travel less distance than those on the right.

You could explain what would happen if the students all approached at 90° to the sand - wavelength and speed would reduce but they would not change direction - just like light in a glass block.

N5 Physics Revision

Past paper selector

Questions on required **experiments** (descriptions and improvements)

Questions that require **explanations**

Suggestions for **Open Ended Questions**

Questions that require **drawing graphs**

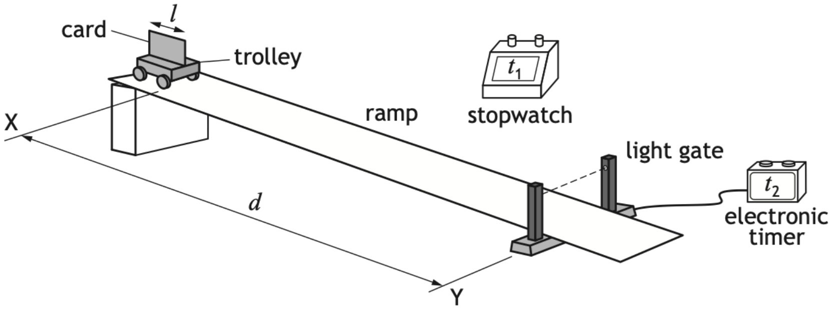
Questions on **unfamiliar Physics**

Questions that require **drawing sketches**

Description of experiments

2024 MC Q2

A student uses the apparatus shown to determine the average speed and instantaneous speed of a trolley as it travels down a slope.



The trolley is released at X and travels down the slope. The distance between X and the light gate at Y is d.

The time taken for the trolley to reach the light gate is t_1.

The length of the card on the trolley is l.

The time taken for the card to pass through the light gate is t_2.

Which row in the table shows the measurements required to determine the average speed of the trolley between X and Y, and the instantaneous speed of the trolley at Y?

	Measurements for average speed between X and Y	Measurements for instantaneous speed at Y
A	l and t_1	d and t_2
B	d and t_1	l and t_2
C	l and t_2	d and t_1
D	d and t_2	l and t_2
E	d and t_1	l and t_1

Description of experiments

2023 MC Q2

A trolley is released from the top of a slope and passes between two light gates P and Q.

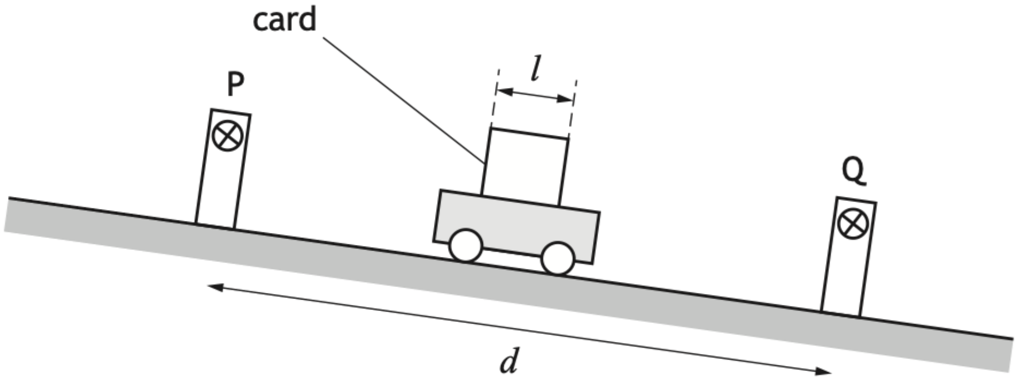
The distance between the light gates is d.

The time taken for the card to pass through light gate P is t_1.

The time taken for the card to pass through light gate Q is t_2.

The length of the card on the trolley is l.

The instantaneous speed of the trolley at light gate Q is given by



A $\dfrac{d}{t_1+t_2}$

B $\dfrac{l}{t_1+t_2}$

C $\dfrac{l}{t_1}$

D $\dfrac{l}{t_2}$

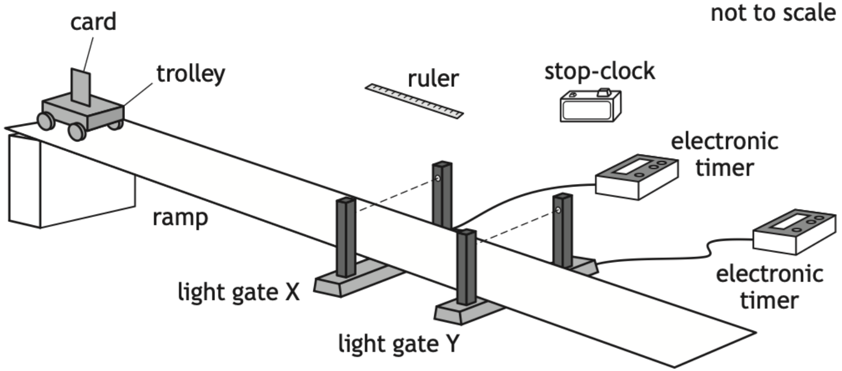
E $\dfrac{d}{t_2}$

Relationship sheet

Description of experiments

2018 Q2ai

Two students are investigating a trolley travelling down a ramp. Some of the measurements made by the student are shown.



Time for the card to pass through light gate Y	0·098 s
Distance between light gate X and light gate Y	0·22 m
Length of the card	0·045 m
Time for trolley to pass between light gate X and light gate Y	0·56 s

Time for card to cut/pass through light gate X

The student determines the instantaneous speed of the trolley at light gate X to be **0·32 ms^{-1}**.

State the **additional** measurement made by the student determine the instantaneous speed of the trolley at light gate X.

Calculations:

- Instantaneous speed at Y **0.46 ms^{-1}**
- Acceleration of the trolley on the slope **0.25 ms^{-2}**

Description of experiments

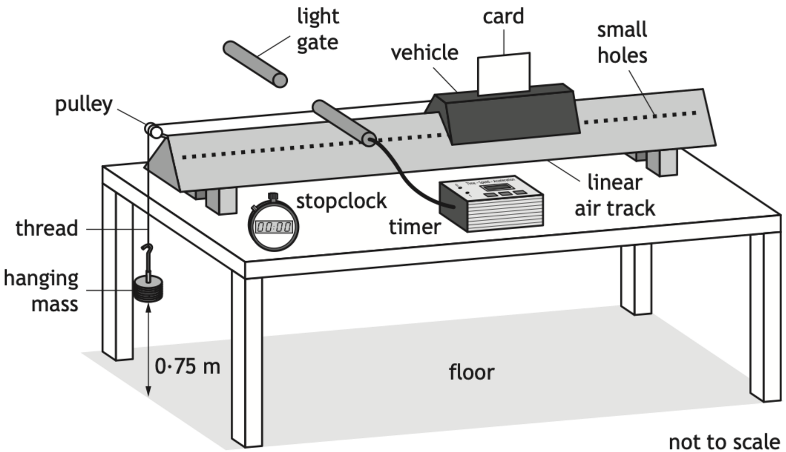
2020 Q2a

A student sets up an experiment using a linear air track.

A vehicle is mounted on the track.

Air is blown into the track and out through small holes in the sides of the track, causing the vehicle to be lifted slightly above the track.

The vehicle is released from rest and the card mounted on it passes through the light gate.



not to scale

i) Explain the purpose of using air to lift the vehicle slightly above the track. **(1)**

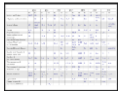
ii) State the measurements the student must make in this experiment to determine the acceleration of the vehicle. **(3)**

i) To **reduce friction (1)**

ii) **length**/width of **card (1)**

time for **card** to **pass through** the (light) **gate (1)**

time taken for **card** to **reach** (light) **gate (1)**

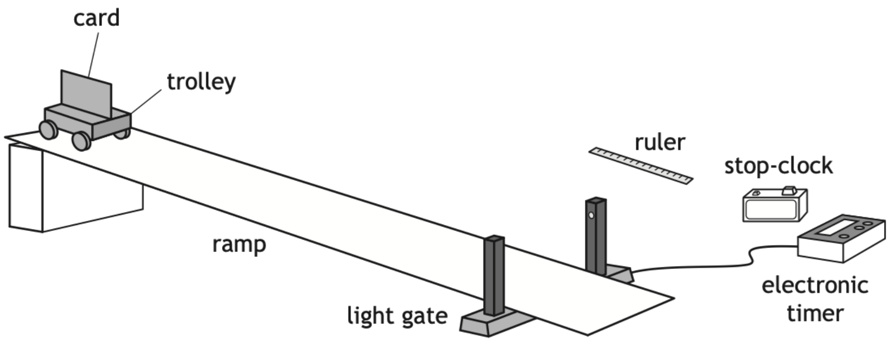


Description of experiments

2015 Q8ai

The student uses the apparatus shown to carry out an experiment to determine the acceleration of a trolley as it rolls down a ramp.

The trolley is released from rest at the top of the ramp.



State the measurements the student must make to calculate the acceleration of the trolley. **(3)**

length/width of card (1)

time taken for **card** to **pass** (through) the **light gate** (1)

time taken for trolley to **travel** from starting position) **to light gate** (1)

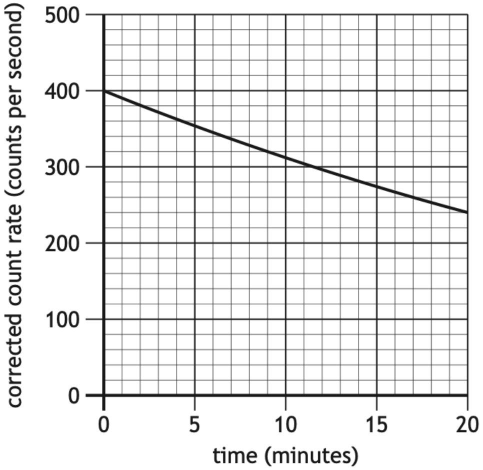
Description of experiments

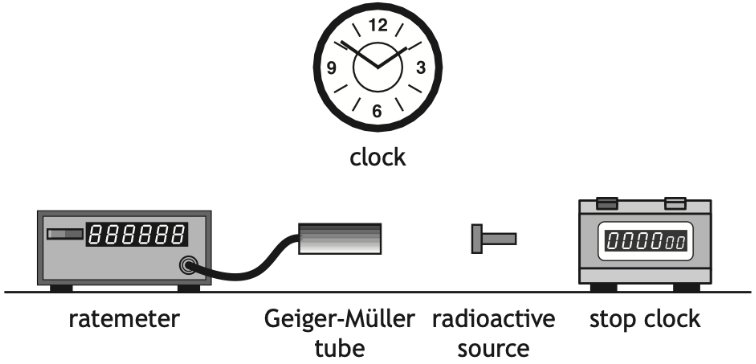
2024 MC Q25

A technician carries out an experiment, using the apparatus shown, to determine the half-life of a radioactive source.

Before carrying out the experiment the technician measures the background count rate.

The technician takes readings of the count rate displayed on the ratemeter every **60 s** for a period of **20 minutes**.





Which of the following changes would allow the technician to more easily determine the half-life of the radioactive source?

A Take readings of the count rate every 30 seconds for 20 minutes.

B Take readings of the count rate every 60 seconds for 40 minutes.

C Place lead shielding around the radioactive source.

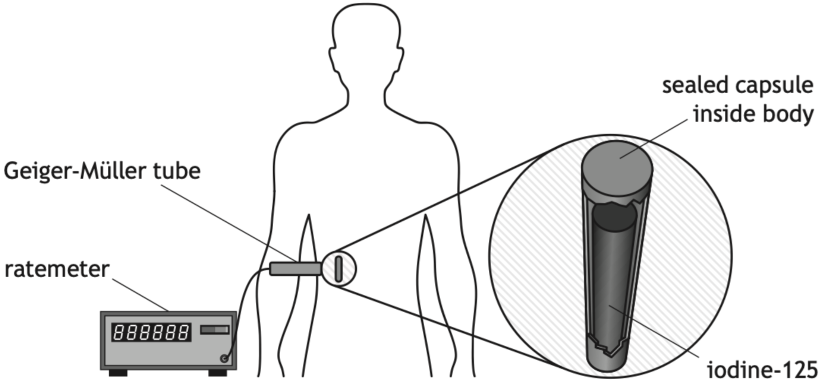
D Move the radioactive source closer to the Geiger-Müller tube.

E Move the radioactive source further away from the Geiger-Müller tube.

Description of experiments

2023 Q14a

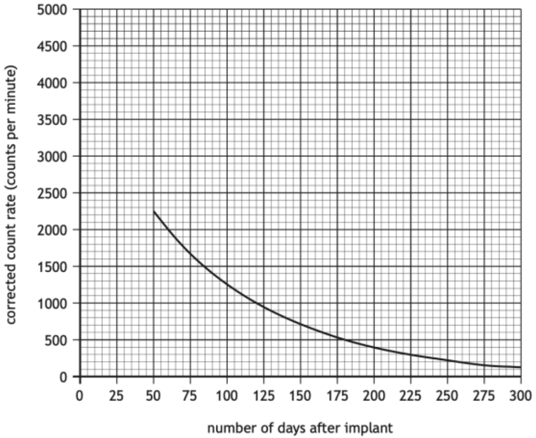
A sealed capsule containing iodine-125 is implanted inside a patient, next to the cancer cells.



Gamma rays emitted by the iodine-125 damage the cancer cells.

A Geiger-Müller tube and ratemeter are used to measure the count rate from the iodine-125.

Measurements of the count rate are taken at regular time intervals. These measurements are used to produce a graph showing how the corrected count rate varies with the number of days after implant.



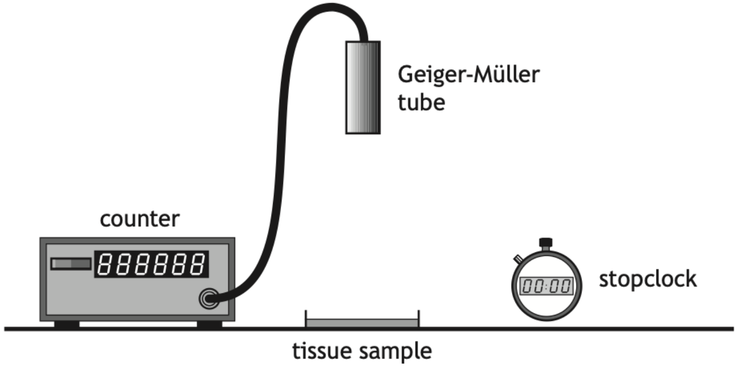
State the additional measurement that must have been made in order to determine the corrected count rate. **(1)**

background count (rate)

Description of experiments

2020 Q12biii

The scientist uses the equipment shown to test a tissue sample to identify if a radioactive DNA probe is present in a tissue sample.



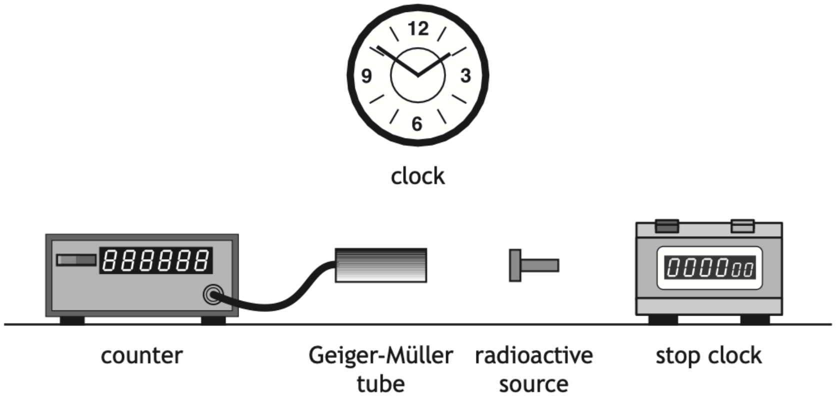
Suggest one change to the set up that would increase the number of decays per minute detected by the Geiger-Müller tube due to the sample. **(1)**

Move the Geiger-Müller tube **closer** (to the tissue sample).

Description of experiments

2019 Q12a

A technician carries out an experiment, using the apparatus shown, to determine the half-life of a radioactive source.



Describe how the apparatus can be used to determine the half-life of the radioactive source. **(3)**

Measure the **count** in a **set time (1)**

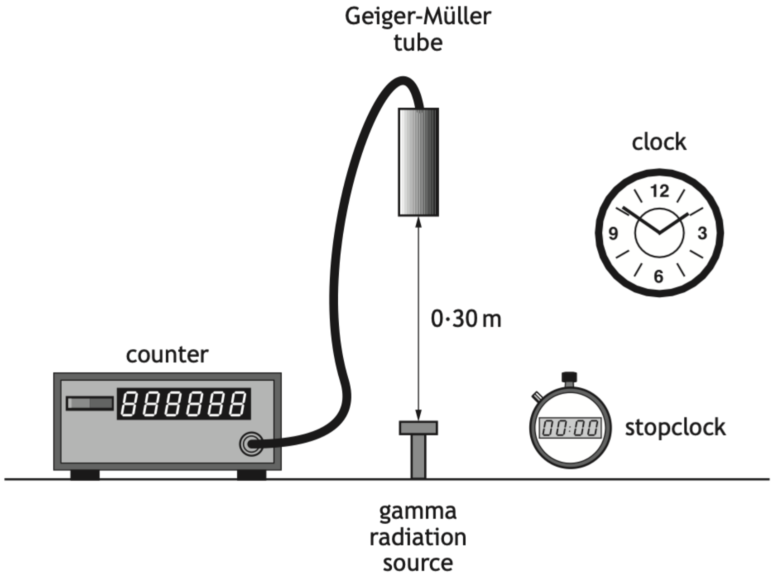
Repeat at (regular) **intervals (1)**

(Measure and) **subtract background** (count) **(1)**

Description of experiments

2018 Q13ai

A technician carries out an experiment, using the apparatus shown, to determine the half-life of a gamma radiation source.



Before carrying out the experiment the technician measures the background count rate.

Explain why this measurement is made. **(1)**

The counter reading will **include the source** and **background** count. **(1)**

OR

Background will need to be **subtracted**.

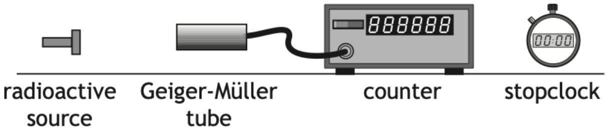
OR

To **measure**/determine the **count rate due** to the **source**.

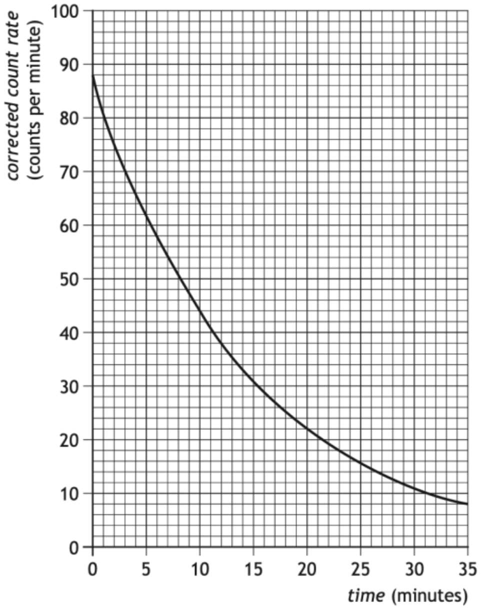
Description of experiments

2014 Q6bi

A technician carries out an experiment, using the apparatus shown, to determine the half-life of a radioactive source.



The technician displays the data obtained from the experiment in the graph on the left.



Describe how the apparatus could be used to obtain the experimental data required to produce this graph. **(3)**

Measure the **count** in a **set time interval (1)**

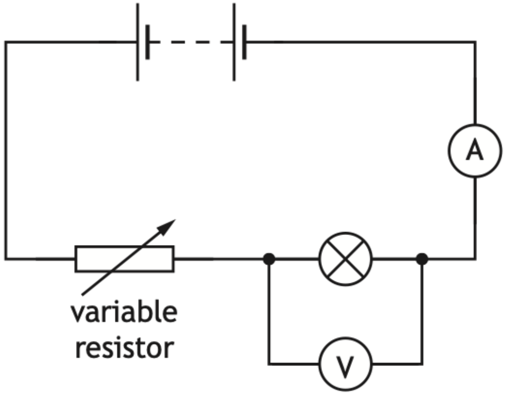
Repeat at (regular) **intervals (1)**

Measure **background** (count) and **subtract (1)**

Description of experiments

2024 Q8aiii

A student sets up the following circuit to investigate the relationship between the current in and the voltage across a lamp.



The student uses the circuit to obtain a range of measurements of current in the lamp and voltage across the lamp.

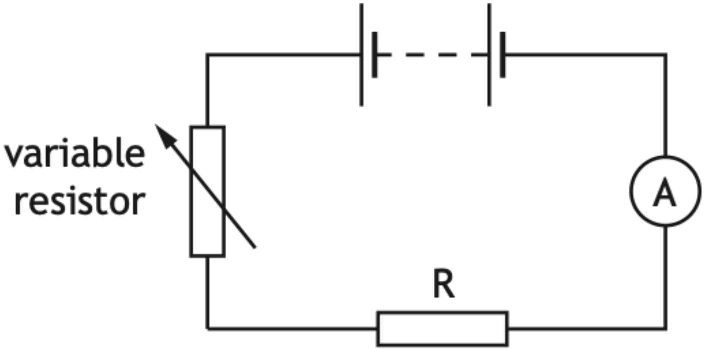
Describe how the student obtained a range of values of current and voltage using this circuit. **(1)**

(The student) **varied** the **resistance** of the **variable resistor (1)**

Description of experiments

2016 Q2a&b

A student investigates the resistance of a resistor using the circuit shown.



a) Complete the circuit diagram to show where a voltmeter must be connected to measure the voltage across resistor R. **(1)**

a) Voltmeter across **resistor R (1)**

b) Describe how the student obtains a range of values of voltage and current. **(1)**

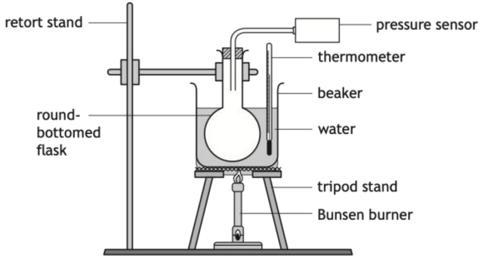
b) increase/decrease/vary/**change** the **resistance** of the **variable resistor (1)**

Description of experiments

2022 Q9a

A group of students are investigating how the pressure of a fixed mass of gas varies with its temperature. This is known as Gay-Lussac's Law.

The students set up an experiment as shown.



The students' results are shown.

Temperature (°C)	Temperature (K)	Pressure (kPa)
50	323	121
60	333	124
70	343	128
80	353	132

Use all the appropriate data to establish the relationship between the pressure and the temperature of the gas. **(3)**

For $\frac{p}{T}$:

$$\left(\frac{121\times10^3}{323}\right) = 375$$

$$\left(\frac{124\times10^3}{333}\right) = 372$$

$$\left(\frac{128\times10^3}{343}\right) = 373$$

$$\left(\frac{132\times10^3}{353}\right) = 374$$

First two marks are awarded for the calculations:

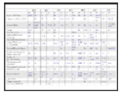
- All four calculations correct **(2)**
- Three calculations correct (1)
- Fewer than three calculations correct (0)

Statement of relationship:

$\frac{p}{T} = constant$ **OR** $\frac{T}{p} = constant$

OR $\frac{p_1}{T_1} = \frac{p_2}{T_2}$

OR p is (directly) proportional to T (in kelvin) **(1)**

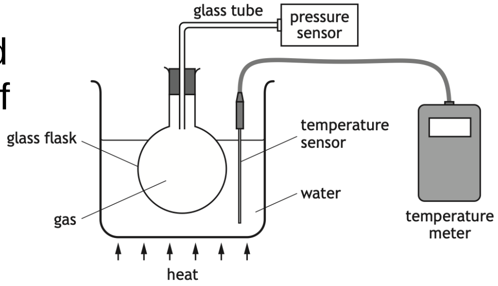


Description of experiments

2018 Q9ai

A student sets up an experiment to investigate the relationship between the pressure and temperature of a fixed mass of gas as shown.

The student heats the water and records the following readings of pressure and temperature.



Pressure (kPa)	101	107	116	122
Temperature (K)	293	313	333	353

Using **all** the data, establish the relationship between the pressure and the temperature of the gas. **(3)**

All four substitutions for $\frac{p}{T}$ OR $\frac{T}{p}$ **(1)**

All values calculated correctly **(1)**

For $\frac{p}{T}$:

$$\frac{101\times10^3}{293} = 345$$

$$\frac{107\times10^3}{313} = 342$$

$$\frac{116\times10^3}{333} = 348$$

$$\frac{122\times10^3}{353} = 346$$

Statement of:

$\frac{p}{T} = constant$ OR $\frac{T}{p} = constant$

OR $\frac{p_1}{T_1} = \frac{p_2}{T_2}$

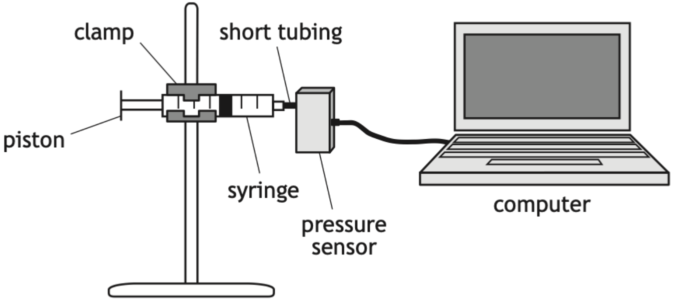
OR p is (directly) proportional to T (in kelvin)

(1)

Description of experiments

SQP Q8a

A student carries out an experiment to investigate the relationship between the pressure and volume of a fixed mass of gas using the apparatus shown.



The pressure *p* of the gas is recorded using a pressure sensor connected to a computer. The volume *V* of the gas in the syringe is also recorded. The student pushes the piston to alter the volume and a series of readings is taken.

The temperature of the gas is constant during the experiment. The results are shown.

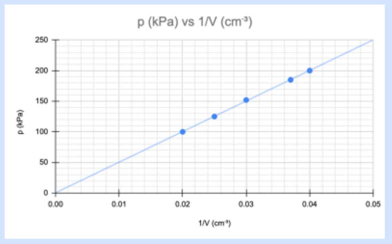
p (kPa)	100	125	152	185	200
V (cm^3)	50	40	33	27	25
$1/V$ (cm^{-3})	0·020	0·025	0·030	0·037	0·040

i) Draw a graph of p against 1/V **(3)**
ii) Explain how the graph confirms that pressure is directly proportional to 1/volume. **(1)**

i) Axes labelled with units **(1)**

Axes scaled linearly **(1)**

Data points accurately plotted with line of best fit **(1)**

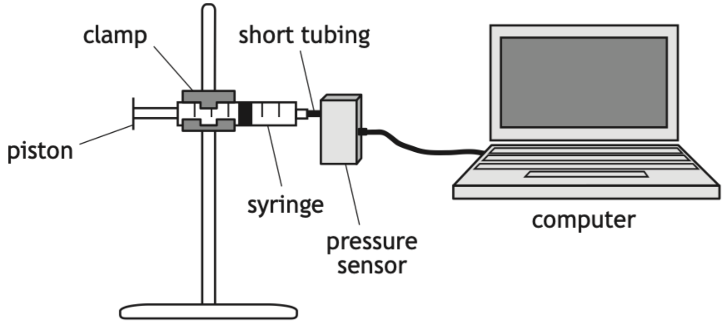


ii) The line of best fit is a straight line which passes through the origin **(1)**

Description of experiments

SQP Q8d

A student carries out an experiment to investigate the relationship between the pressure and volume of a fixed mass of gas using the apparatus shown.



i. When carrying out the experiment, the student clamped the syringe rather than holding it in their hand.

   Explain why this is better experimental practice. **(2)**

ii. A second student suggests that replacing the short tubing between the syringe and the pressure sensor with one of longer length would improve the experiment.

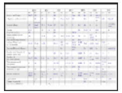
   Explain why this student's suggestion is incorrect. **(2)**

i.Using a clamp will prevent **heat** from the student's hand **increasing the temperature** of the gas in the syringe **(1)**

If the **temperature** of the gas in the syringe is **not constant**, the experiment would **not be valid (1)**

ii The suggestion is incorrect because the **volume of air** in the tubing is **not** being read from the **scale** on the **syringe (1)**

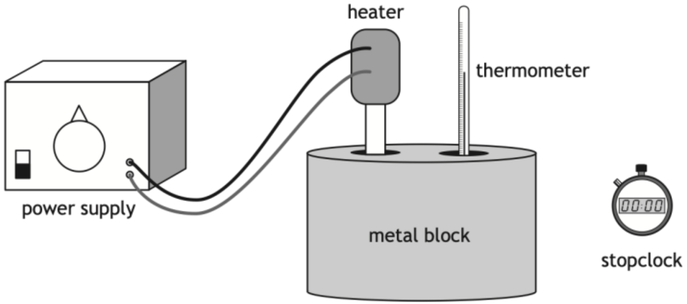
A **longer length** of **tubing** would **increase** the (systematic) **uncertainty** in the **experiment (1)**



Description of experiments

2014 Q3a

A student is investigating the specific heat capacity of three metal blocks X, Y and Z.



The heater has a power rating of 15 W.

The initial temperature of the block is measured.

The heater is switched on for 10 minutes and the final temperature of the block is recorded.

This procedure is repeated for the other two blocks.

The student's results are shown in the table.

Block	*Initial temperature* (°C)	*Final temperature* (°C)
X	15	25
Y	15	85
Z	15	34

Calculations:

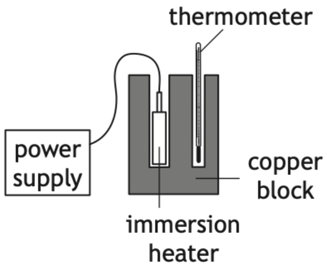
- Find energy provided by heater. **9000 J**
- Identify block with largest value of *c*. **X**
- Calculate specific heat capacity of block with largest value of *c*. **900 $Jkg^{-1}°C^{-1}$**

Description of experiments

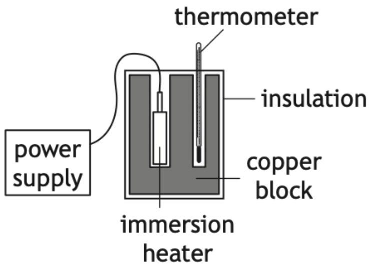
2017 MC Q5

Five students each carry out an experiment to determine the specific heat capacity of copper. The setup used by each student is shown.

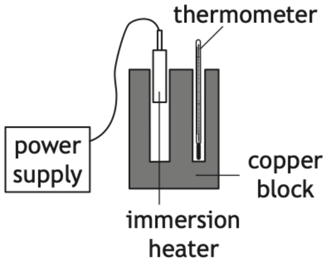
Student 1



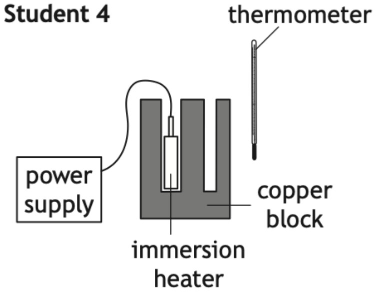
Student 2



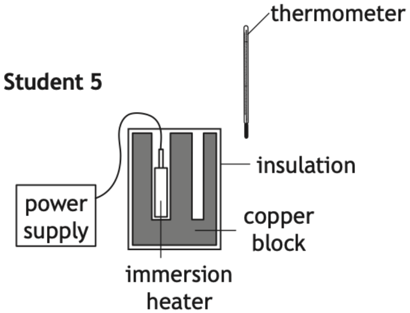
Student 3



Student 4



Student 5



The student with the setup that would allow the most accurate value for the specific heat capacity of copper to be determined is

A student 1

B student 2

C student 3

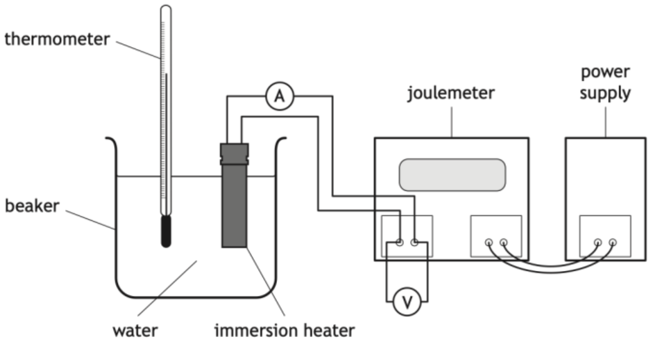
D student 4

E student 5.

Description of experiments

2018 Q8a

A student carries out an experiment, using the apparatus shown, to determine a value for the specific heat capacity of water.



The student switches on the power supply and the immersion heater heats the water.

The joulemeter measures the energy supplied to the immersion heater.

The student records these measurements.

energy supplied to immersion heater = 21 600 J
mass of water = 0·50 kg
initial temperature of the water = 16 °C
final temperature of the water = 24 °C
reading on voltmeter = 12 V
reading on ammeter = 4·0 A

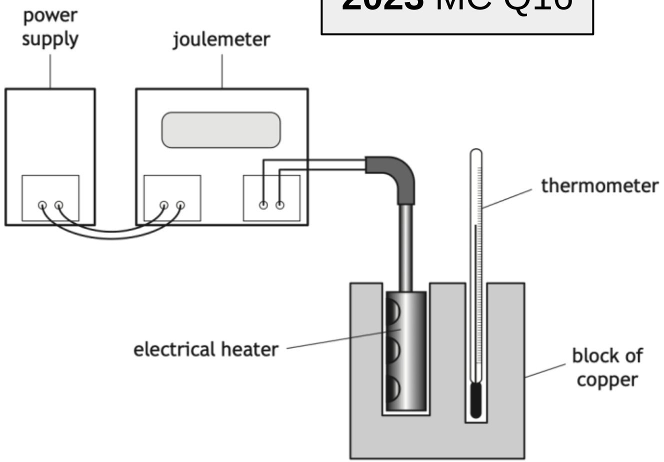
Calculations:

- Calculate the specific heat capacity.
  5 400 $Jkg^{-1}°C^{-1}$
- Why is the value different from the data sheet value?
  Heat (energy) is **lost** to the **surroundings**/to air.
- For how long is the immersion heater on in this experiment?
  450 s

Description of experiments

2023 MC Q16

A student carries out an experiment to determine the specific heat capacity of copper using the apparatus shown.



The student switches on the power supply and the electrical heater heats the block of copper. The joulemeter measures the energy supplied to the electrical heater.

The student suggests the following measurements should also be made:

I The mass of the block of copper.

II The initial and final readings on the thermometer.

III The power rating of the electrical heater.

Which of these measurements must be made to determine the specific heat capacity of copper?

A I only

B II only

C I and II only

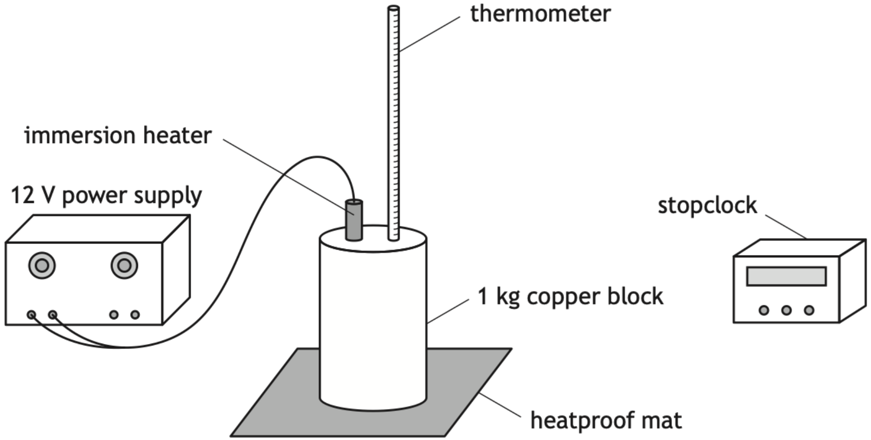
D II and III only

E I, II and III

Description of experiments

2024 MC Q15

A student carries out an experiment to determine the specific heat capacity of copper. The setup used by the student is shown.



The student heats the copper block for 5 minutes.

The temperature of the block increases by 14 °C.

The value of the specific heat capacity of copper determined by the student using this method is found to be inaccurate.

Which of the following changes would improve the accuracy of this experiment?

A Heating the copper block for a longer time.

B Placing insulation around the copper block.

C Replacing the copper block with one of less mass.

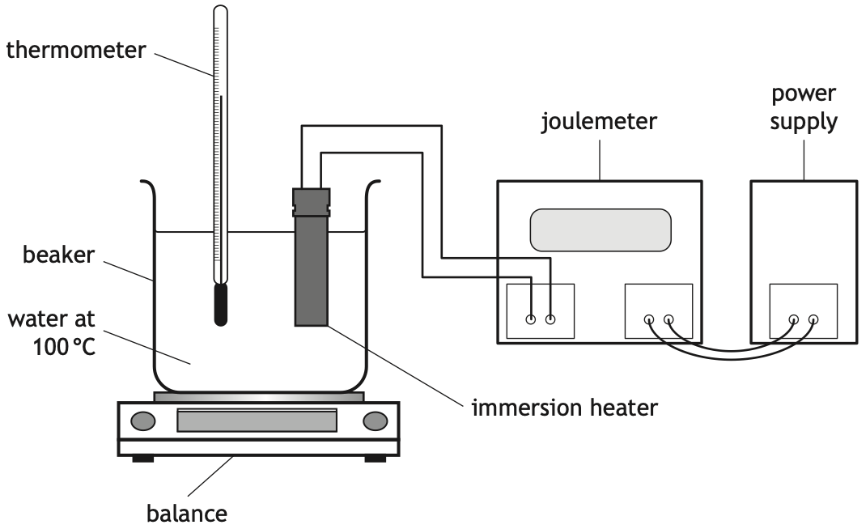
D Replacing the immersion heater with one of a higher power rating.

E Removing the heatproof mat.

Description of experiments

2018 Q8c

The student then carries out a second experiment, using the apparatus shown, to determine a value for the specific latent heat of vaporisation of water.



Describe how this apparatus would be used to determine a value for the specific latent heat of vaporisation of water.

Your description must include:

- measurements made
- any necessary calculations **(3)**

(Measure the) **mass** of **water evaporated**. **(1)**

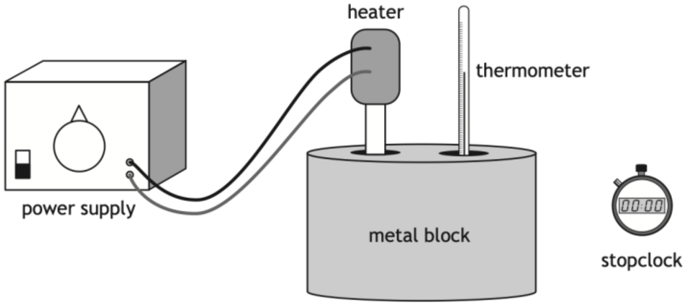
(Measure the) **energy supplied**. **(1)**

$\mathbf{E_h = ml}$ **(1)**

Description of experiments

2014 3c

A student is investigating the specific heat capacity of three metal blocks X, Y and Z.



Due to energy losses, the specific heat capacities calculated in this investigation are different from the accepted values.

The student decides to improve the set up in order to obtain a value closer to the accepted value for each block.

Suggest a possible **improvement** that would reduce energy losses. **(1)**

Insulating the (metal) block

OR

Switch **heater on** for **shorter time**

Description of experiments

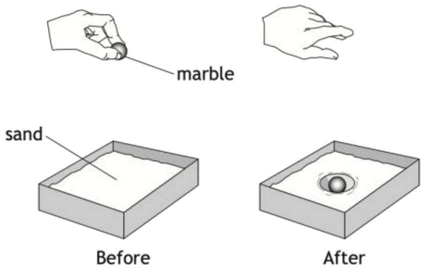
2015 11b

A student investigates how a crater is formed by dropping a marble into a tray of sand.

The student drops the marble from different heights and measures the diameter of each crater that is formed.

The table shows the student's results.

height (m)	*diameter* (m)
0·05	0·030
0·10	0·044
0·15	0·053
0·35	0·074
0·40	0·076
0·45	0·076



Suggest **two improvements** that the student could make to this investigation. **(2)**

Any **two** from:

Repeat (and average)

Take (**more**) **readings** in the **0·15 (m)** to **0·35 (m)** drop **height range**

increase the **height range**

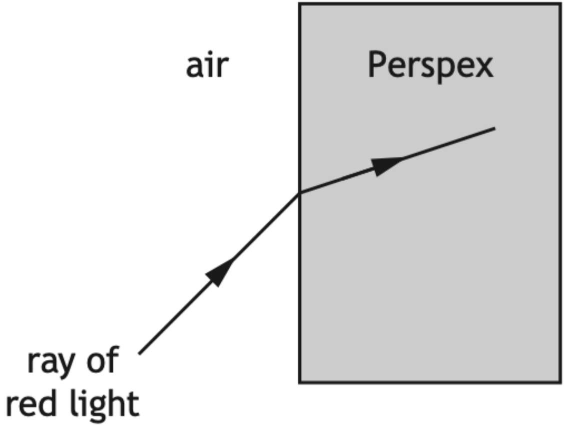
level sand between drops

or other **suitable improvement**

Description of experiments

2016 6c

A student directs a ray of red light into a Perspex block to investigate refraction.



Suggest why it would be good practice for the student to repeat the investigation a further three or four times. **(1)**

Any **one** of:

To **obtain** more **reliable** results

Eliminate rogue results/outliers

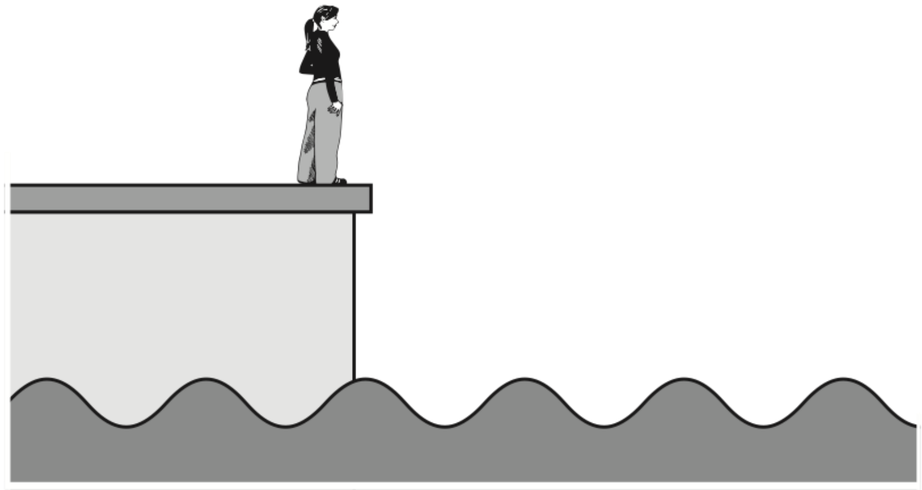
To allow an **average**/mean to be calculated

More accurate

Description of experiments

2017 4aii

A student observes water waves entering a harbour.



Suggest how the **accuracy** of the frequency determined by the student could be improved. **(1)**

measure the **time for more waves** to pass

OR

count the **number** of **waves** in a **longer** period of **time**

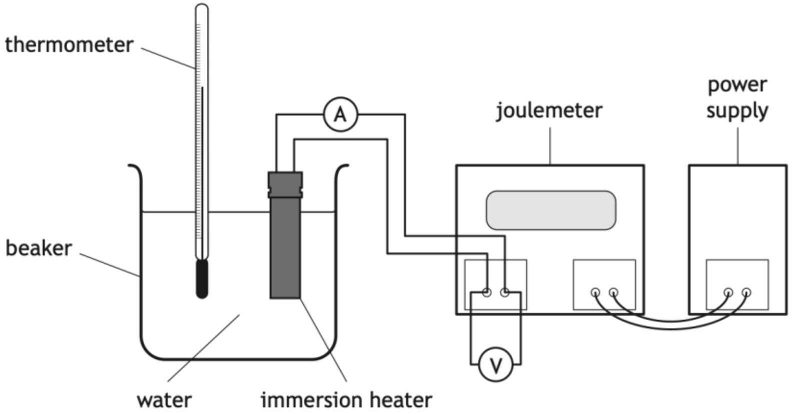
OR

repeat (the measurement) **and average**

Description of experiments

2018 8aii

A student carries out an experiment, using the apparatus shown, to determine a value for the specific heat capacity of water.



Explain why the value determined from the experiment is different from the value quoted in the data sheet. **(1)**

Heat (energy) is **lost** to the **surroundings**/to air.

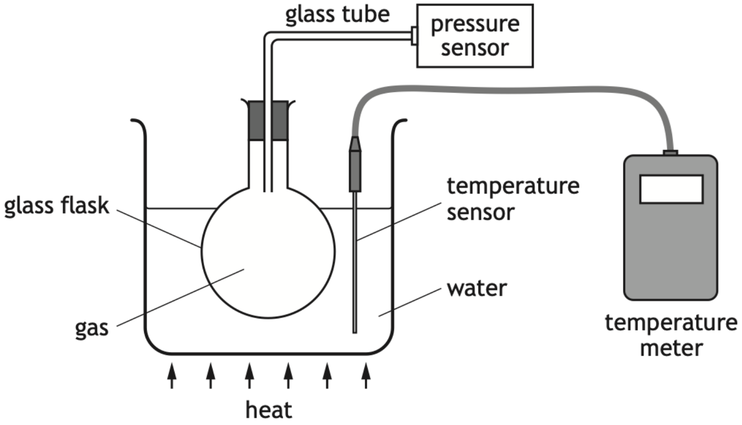
OR

some of the **heat** (energy) is **used to heat up** the **heater**/**beaker**.

Description of experiments

2018 9b

A student sets up an experiment to investigate the relationship between the pressure and temperature of a fixed mass of gas as shown.



State one way in which the set-up of the experiment could be **improved** to give more **reliable** results.

Justify your answer. **(2)**

Have **more of the flask under** the **water**, so that the **gas is at the same temperature** /evenly heated

OR

Reduce the length/diameter/volume of the **connecting tube** so that the **gas is at the same temperature** /evenly heated

Accept:

Place the **temperature sensor** in the **flask** (1)

So that the temperature of the gas is being measured (1)

OR (so that all the gas is being heated'

Do not accept:

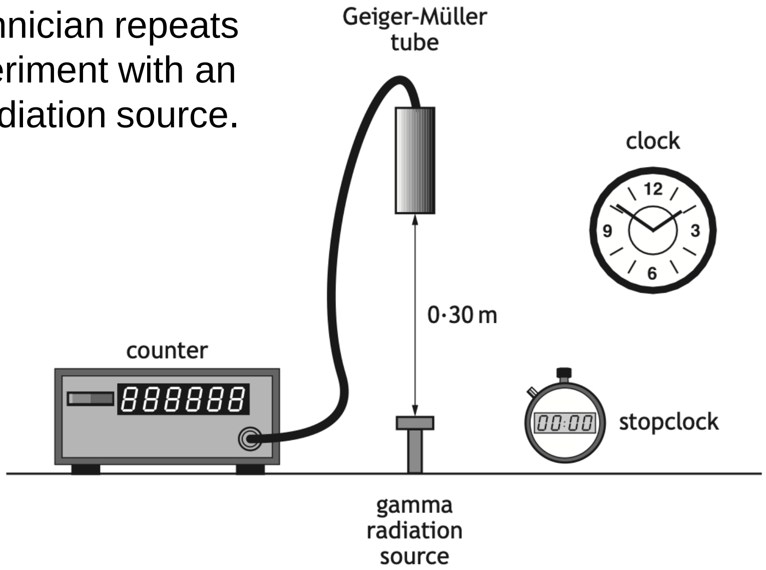
'repeat measurements' – it is an improvement to the set up that is required

Description of experiments

2018 13ci

A technician carries out an experiment, using the apparatus shown, to determine the half-life of a gamma radiation source.

The technician repeats the experiment with an alpha radiation source.



Suggest a change the technician must make to the experimental set-up to determine the half-life of the alpha radiation source.

Justify your answer. **(2)**

Reduce the **distance** (between the detector and the source) **(1)**

Alpha is **absorbed** by a **few cm of air/range** in **air** is a **few cm. (1)**

OR

Alpha has a **shorter range** (than gamma).

Description of experiments

2019 5aiv

A student is investigating how the length of a wire affects its resistance.

The student connects different lengths of wire to a power supply of fixed voltage and measures the current in each length of wire.

The measurements taken by the student are shown in the table.

Length of wire (m)	Current (A)
0·20	0·94
0·40	0·66
0·60	0·47
0·80	0·37
1·00	0·32

Suggest one way in which the experimental procedure could be improved to give more **reliable** results. **(1)**

repeat (and average)

Accept:

increase the **range** of **lengths**

increase the **number** of **different lengths**

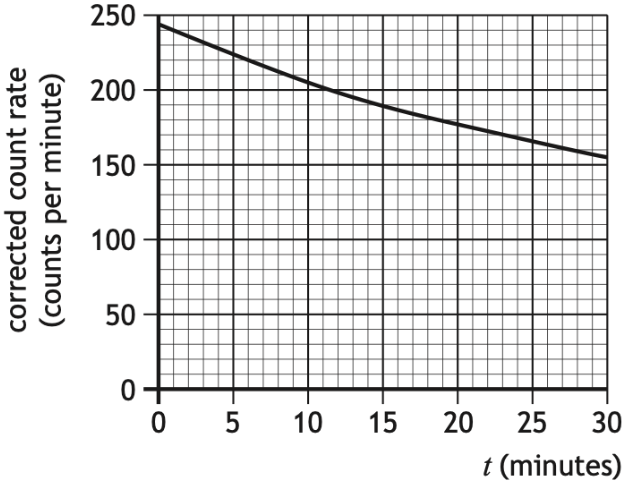
If candidates use the terms **'accurate'** and/or **'precise'** in their response, they **must** be used **correctly** otherwise (0).

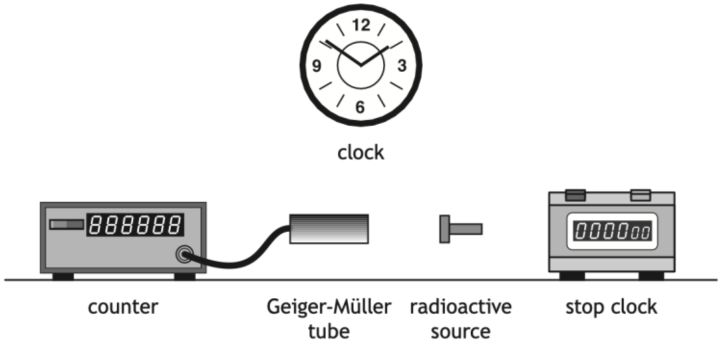
Description of experiments

2019 12b

A technician carries out an experiment, using the apparatus shown, to determine the half-life of a radioactive source.

The technician carries out the experiment over a period of 30 minutes, and displays the data obtained in a graph as shown.





Suggest an **improvement** that the technician could make to the procedure to more easily determine a value for the half-life of this source. **(1)**

Carry out experiment over a **longer time period.**

Description of experiments

2020
11ciii

A student investigating sound cuts a drinking straw as shown.

The student carries out an experiment to investigate how the length of the straw affects the frequency of the sound produced. The results of this experiment are as shown.

Length of straw (mm)	Frequency (Hz)
20	1204
40	597
60	420
80	282
100	250

Suggest one change that could be made to improve the **reliability** of this experiment. **(1)**

Repeat (measurements and average) (1)

Accept:

- **Increase** the **range** of **lengths.**
- **Increase** the **number** of **different lengths.**

If candidates use the term **'accurate'** and/or **'precise'** in their response, they **must** be used **correctly**, otherwise (0)

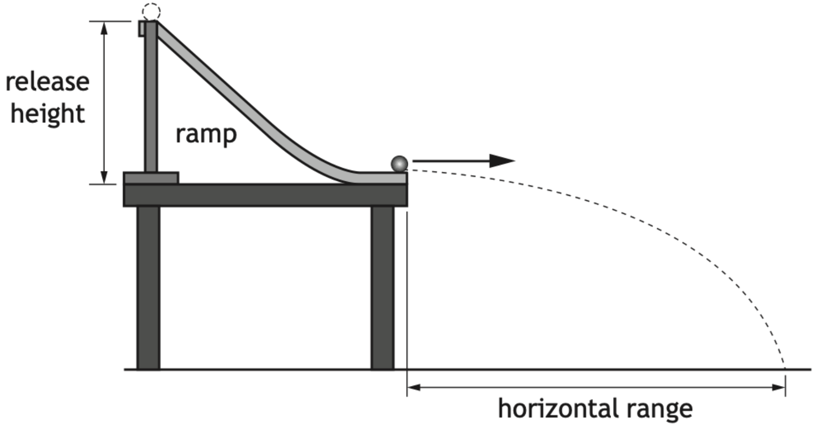
Description of experiments

2022 2aiii

A student is investigating factors that affect the horizontal range of a marble, using the apparatus shown.

The student releases a marble from different heights on the ramp and measures the horizontal range.

In order to measure the horizontal range, the student watched to see where the marble hit the ground.



Suggest an **improvement** to the experiment to determine more accurately where the marble hit the ground. **(1)**

Place carbon paper under **landing site (1)**

OR

Place sand tray under landing site

OR

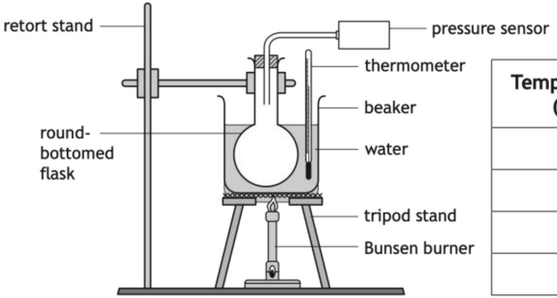
Use **video analysis**

Description of experiments

2022 9c

A group of students are investigating how the pressure of a fixed mass of gas varies with its temperature. This is known as Gay-Lussac's Law.

The students set up an experiment as shown.



The students' results are shown.

Temperature (°C)	Temperature (K)	Pressure (kPa)
50	323	121
60	333	124
70	343	128
80	353	132

Suggest one way the students could **improve** the experiment. **(1)**

Repeat the experiment

OR **Increase** the **range** (of **temperatures**)

OR Take **readings** at **more** (different) **temperatures** within the range

OR Have **more** of the **flask** in the **water**

OR **Add more water** (in the beaker)

OR **Reduce** the **length**/diameter of the **connecting tube**

OR **Stir** the **water**

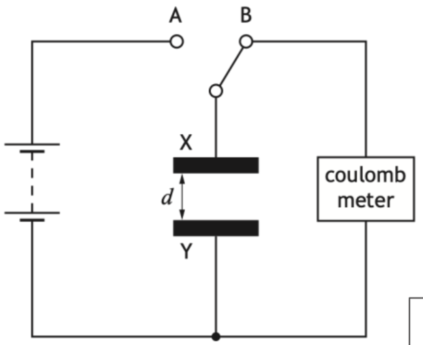
Accept:

Place **thermometer inside** the **flask**/in the gas.

Description of experiments

2023 7b

A capacitor consisting of two parallel metal plates, X and Y, is connected in a circuit as shown.



The charge Q stored on the capacitor for a range of different distances d between plate X and plate Y is shown in the table.

d (mm)	Q ($\times 10^{-12}$ C)
10	178
20	90
30	62
40	47
50	37

Suggest two ways in which the experimental procedure could be **improved**. **(2)**

Any **two** of the following for (1) mark each:

Repeat measurements and **average**

Repeat measurements to **identify outliers**/rogue points

Increase the **range** of **distances**

Increase the **number** of **different distances**

Do not accept:

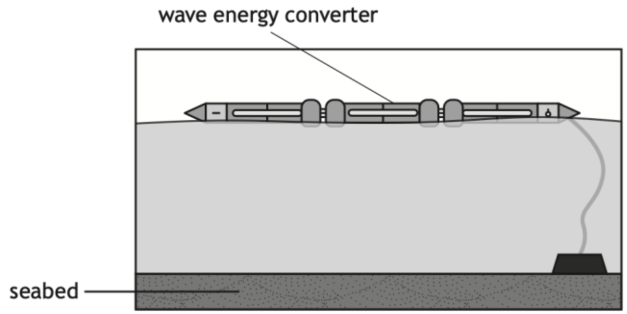
'repeat measurements' alone

'more readings' alone

Description of experiments

2024
11bii

A wave energy converter is a machine anchored to the seabed that changes the kinetic energy of water waves into electrical energy.



An engineer uses a stopwatch to measure the time taken for one complete wave to pass the end of the converter.

The stopwatch is started when a crest passes the end of the converter and stopped when the next crest passes.

Suggest how the **accuracy** of the frequency of the waves determined by the engineer could be improved. **(1)**

measure (the time for) **more waves** to **pass**

OR

count the **number** of **waves** in a **longer period** of **time**

OR

repeat (the measurement) and **average**

N5 Physics Revision

Past paper selector

Questions on required **experiments** (descriptions and improvements)

Questions that require **explanations**

Suggestions for **Open Ended Questions**

Questions that require **drawing graphs**

Questions on **unfamiliar Physics**

Questions that require **drawing sketches**

← *Back to* ***Description of experiments*** *questions*

Relationships sheet

Dynamics

$d = vt$

$F = ma$

$d = \bar{v}t$

$W = mg$

$s = vt$

$E_w = Fd$

$s = \bar{v}t$

$E_p = mgh$

$a = \frac{v-u}{t}$

$E_k = \frac{1}{2}mv^2$

Electricity

$Q = It$

$P = \frac{E}{t}$

$V = IR$

$V_2 = \left(\frac{R_2}{R_1 + R_2}\right)V_S$

$P = IV$

$P = I^2R$

$\frac{V_1}{V_2} = \frac{R_1}{R_2}$

$P = \frac{V^2}{R}$

$R_T = R_1 + R_2 + ...$

$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + ...$

Properties of matter

$E_h = cm\Delta T$

$p_1V_1 = p_2V_2$

$E_h = ml$

$\frac{p_1}{T_1} = \frac{p_2}{T_2}$

$p = \frac{F}{A}$

$\frac{V_1}{T_1} = \frac{V_2}{T_2}$

$\frac{pV}{T} = \text{constant}$

Radioactivity

$A = \frac{N}{t}$

$H = Dw_r$

$D = \frac{E}{m}$

$\dot{H} = \frac{H}{t}$

Waves

$f = \frac{N}{t}$

$v = f\lambda$

$T = \frac{1}{f}$

N5 Physics Revision

Past paper selector

Questions on required **experiments** (descriptions and improvements)

Questions that require **explanations**

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Questions on **unfamiliar Physics**

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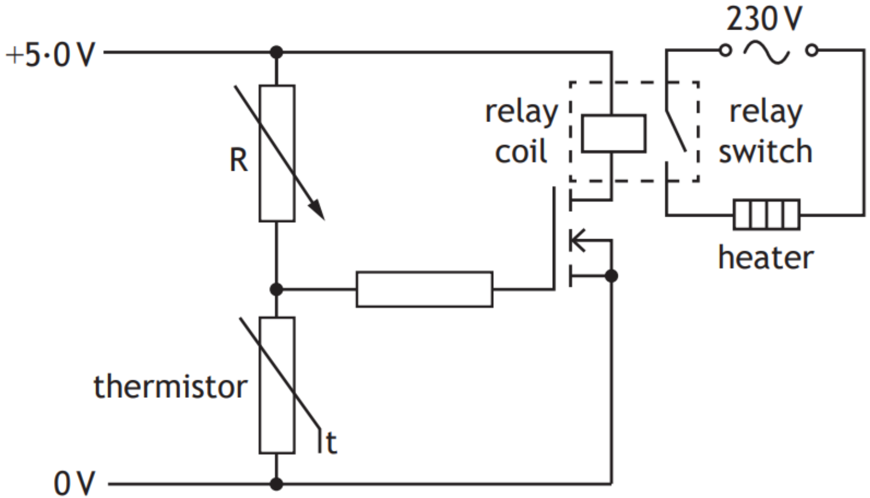
NPN and MOSFET (transistors)

2014 2bi

The circuit is now connected to a switching circuit to operate a heater



Explain how the circuit operates to switch on the heater when the temperature falls below a certain value. **(3)**

As Resistance of thermistor increases **Voltage across thermistor increases (1)**

When Voltage across thermistor = 2·0 V or V reaches switching voltage, **MOSFET/transistor turns on (1)**

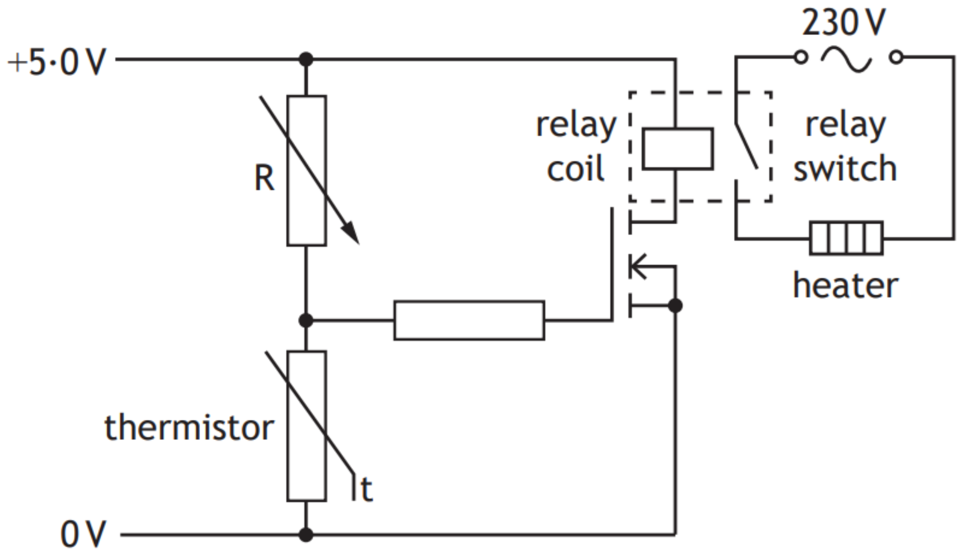
Relay switches on (the heater). **(1)**

Calculations:

- Lots of potential divider questions to test understanding. TRY IT!

NPN and MOSFET (transistors)

2014 2bii



The resistance of the variable resistor R is now increased. What effect does this have on the temperature at which the heater is switched on?

You must justify your answer. **(3)**

Temperature **decreases** (1)

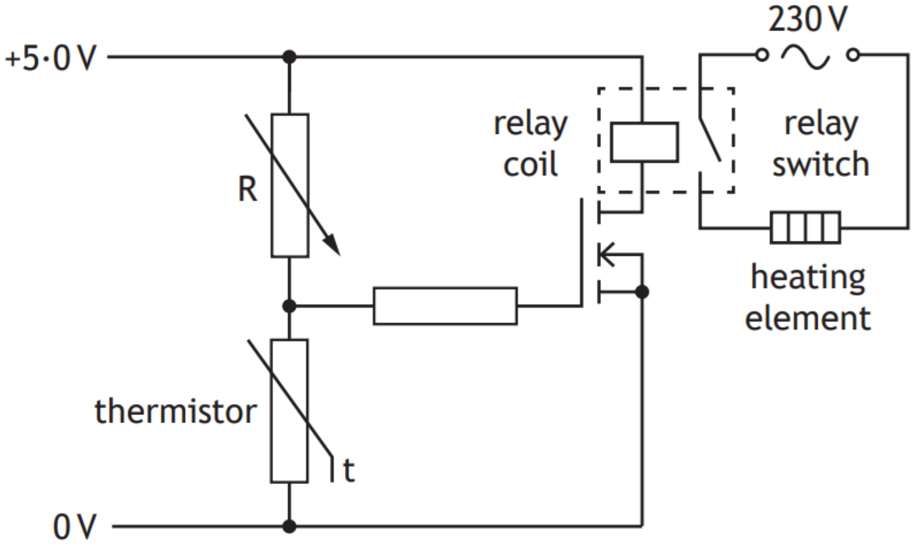
Resistance of thermistor must be **greater** / increase (1)

to **switch** on **MOSFET** / transistor (1)

NPN and MOSFET (transistors)

2016 3c

The temperature of the water in the washing machine is monitored by a circuit containing a thermistor.



As the temperature of the water increases, the resistance of the thermistor decreases.

The heating element is switched off when the temperature of the water reaches 40 ºC.

Explain how the circuit operates to **switch off** the heating element. **(3)**

Voltage across **thermistor decreases** (1)

MOSFET/transistor switches **off/**deactivates (1)

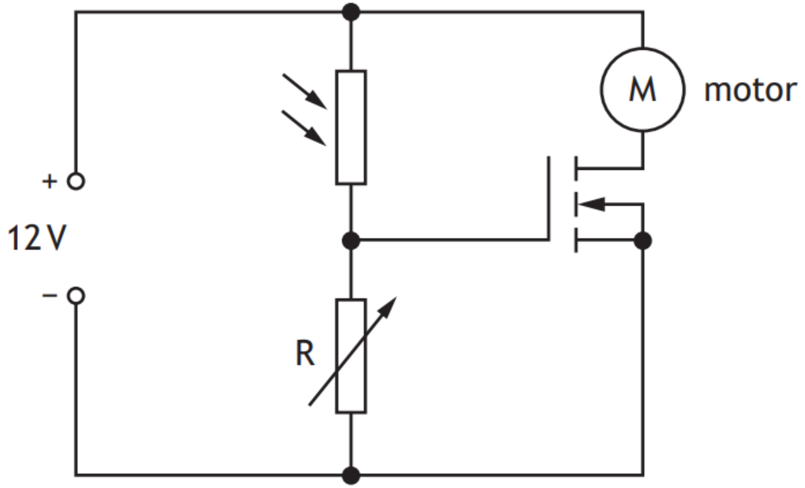
Relay switches off/relay switch opens/relay deactivates (1)

NPN and MOSFET (transistors)

SPQ 6a

An office has an automatic window blind that closes when the light level outside gets too high.

The electronic circuit that operates the motor to close the blind is shown.



The MOSFET switches on when the voltage across variable resistor R reaches 2·4 V.

(i) Explain how this circuit works to close the blind. **(3)**

(ii) What is the purpose of the variable resistor R? **(1)**

(i) Light level **increases**, **LDR resistance decreases** 1

LDR resistance **decreases**, **voltage across R increases** 1

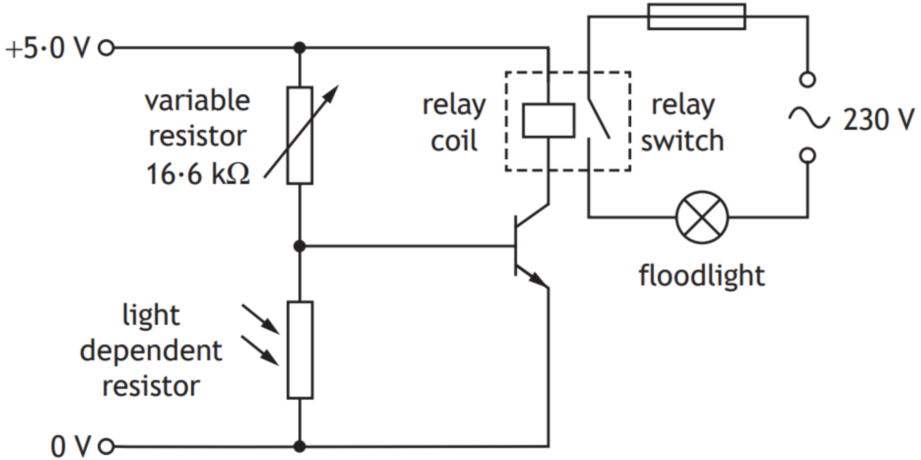
Voltage across R **increases**, **MOSFET switches** the **motor on** 1

(ii) The variable resistor controls the light level at which the motor operates the blind

NPN and MOSFET (transistors)

2020 7bi

A security floodlight is used to automatically illuminate an area outside a building when it gets dark. The circuit for this system is shown.



The floodlight is connected in a part of the circuit controlled by a relay.

Explain why a relay is used in the circuit. **(1)**

The control circuit operates at 5 V, the floodlight at 230 V.

Accept: The two parts of the circuit operate at different voltages. **OR**
The floodlight requires a higher current than can be supplied in the transistor circuit.

Calculations:

- Show that the transistor is switched on if the resistance of the LDR is **3.4 kΩ** and the switch on voltage is **0.7 V**.

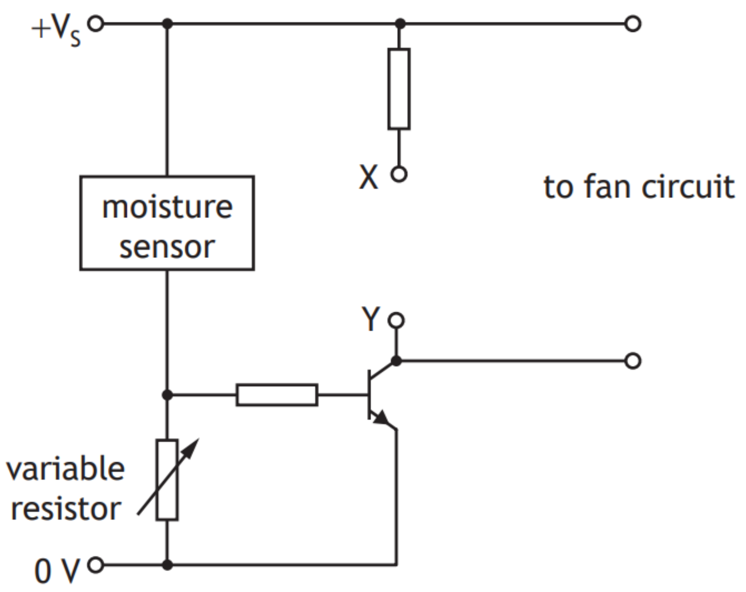
  transistor on, since V_2 = 0.85 V

- If floodlight has power rating **575 W**, determine current in floodlight. **2.5 A**

NPN and MOSFET (transistors)

2022 7c

The dehumidifier switches on automatically when the moisture in the air increases above a certain level. This causes an LED to light and a fan to turn on.



(ii) The voltage across the moisture sensor decreases as the moisture in the air increases.

Explain how the circuit operates to turn on the LED when the moisture in the air increases above a certain level. **(2)**

(iii) Explain the purpose of the variable resistor in this circuit. **(1)**

(ii) **Voltage** across **variable resistor increases (1)**

Transistor switches on (1)

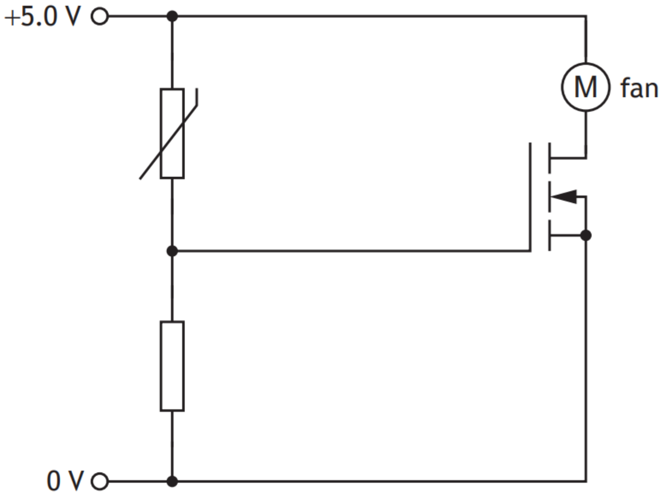
(iii) To adjust/control the moisture level at which the dehumidifier/transistor LED/fan switches on. **(1)**

NPN and MOSFET (transistors)

2024 7c

The charger contains a fan that switches on automatically when the temperature of the charger increases above a certain level.

Part of the circuit containing the fan is shown.



As the temperature of the charger increases, the resistance of the thermistor decreases.

Explain how the circuit operates to switch on the fan when the temperature of the charger increases above a certain level. **(3)**

(As the temperature increases) the **voltage** across the **<u>thermistor</u> decreases** (1)

Voltage across the **resistor increases** (1)

MOSFET turns on (1)

N5 Physics Revision

Past paper selector

Questions on required **experiments** (descriptions and improvements)

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Questions on **unfamiliar Physics**

Questions that require **drawing sketches**

← Back to **Electricity (explanation)** questions

Relationships sheet

Dynamics

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$s = \bar{v}t$

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$a = \frac{v-u}{t}$

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$Q = It$

$P = \frac{E}{t}$

$V = IR$

$V_2 = \left(\frac{R_2}{R_1 + R_2}\right)V_S$

$P = IV$

$P = I^2R$

$\frac{V_1}{V_2} = \frac{R_1}{R_2}$

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$E_h = cm\Delta T$

$p_1V_1 = p_2V_2$

$E_h = ml$

$\frac{p_1}{T_1} = \frac{p_2}{T_2}$

$p = \frac{F}{A}$

$\frac{V_1}{T_1} = \frac{V_2}{T_2}$

$\frac{pV}{T} = \text{constant}$

Radioactivity

$A = \frac{N}{t}$

$H = Dw_r$

$D = \frac{E}{m}$

$\dot{H} = \frac{H}{t}$

Waves

$f = \frac{N}{t}$

$v = f\lambda$

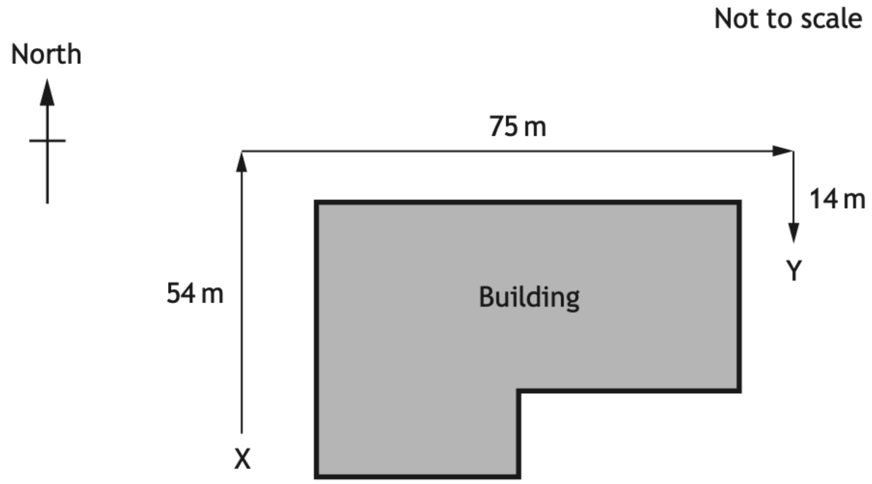
$T = \frac{1}{f}$

Distance and displacement

2016 9bii

A student walks around a building from point X to point Y.

The student takes **68s** to walk from X to Y.



The student states that their average speed between point X and point Y is greater than the magnitude of their average velocity between point X and point Y.

Explain why the student is correct. **(2)**

distance is **greater** (than displacement) **(1)**

same time (1)

Calculations:

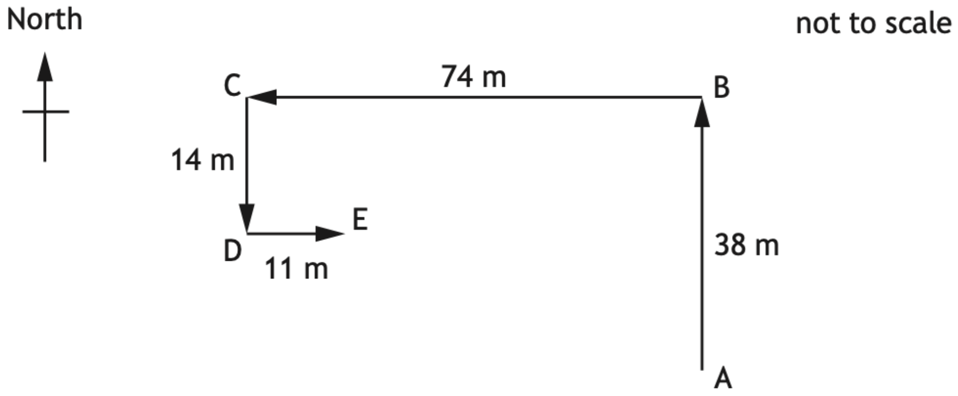
- magnitude of displacement. **85m**
- direction of displacement. **062**
- average velocity from X to Y **1.3ms^{-1} at 062**

Distance and displacement

2023 1bii

A seagull flies above a school playground. The seagull remains at a constant height above the ground during its flight.

The seagull flies from point A to point E in **31s** using the route shown.



A student states that the average speed of the seagull between point A and point E is greater than the magnitude of the average velocity of the seagull between point A and point E.

Explain why the student is correct. **(2)**

distance is **greater** (than displacement) **(1)**

same time (1)

Calculations:

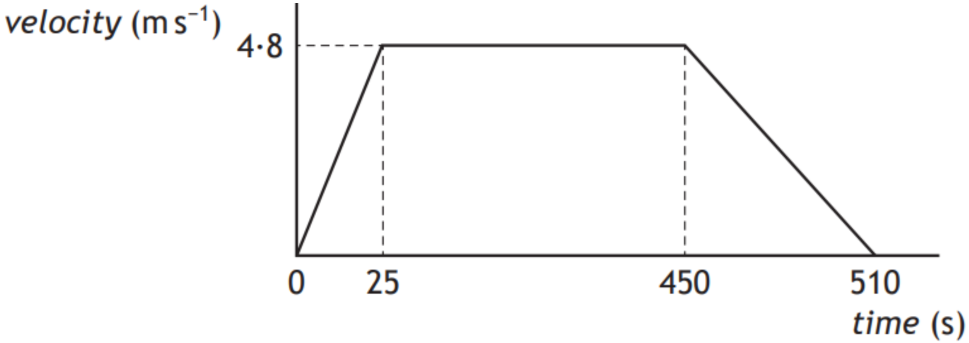
- magnitude of displacement. **67 m**
- direction of displacement. **291**
- average velocity from A to E

2.2 ms^{-1} at 291

Free body diagrams and Newton's Laws

2014 10e

In a rowing event a boat moves off in a straight line.
A graph of the boat's motion is shown.

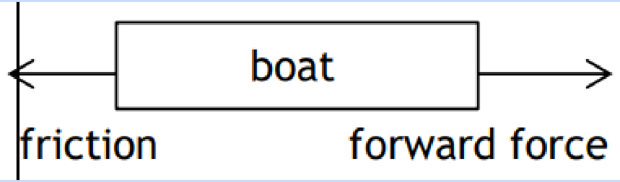


Draw a diagram showing the horizontal forces acting on the boat between 25 s and 450 s.

You must name these forces and show their directions. **(2)**

For **forward force** there are other acceptable answers such as **thrust**, **push**(ing) (force), etc **(1)**

For **friction** also accept **water resistance**, **drag**. **(1)**



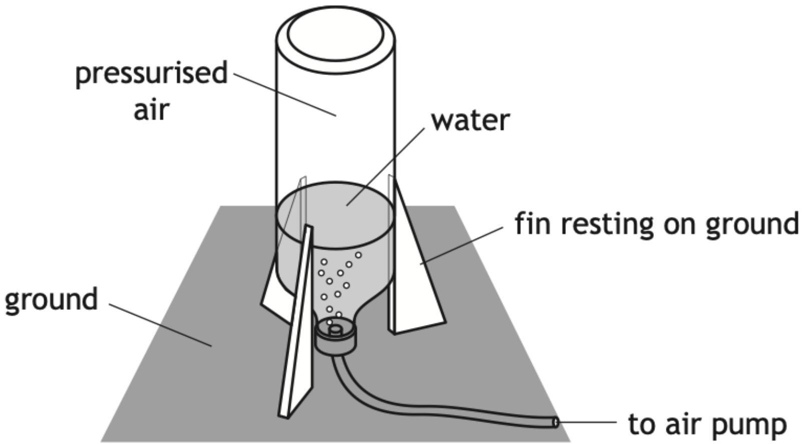
Calculations:

- Acceleration in first 25 seconds. **0.19ms^{-2}**
- Distance travelled after 510 s. **2244 m**
- Average velocity of the boat **4.4 ms^{-1}**

Free body diagrams and Newton's Laws

2014 12c

A student is investigating the motion of water rockets.



Use Newton's Third Law to explain how the rocket launches. **(1)**

Rocket / bottle **pushes down** on **water**,

water pushes up on **rocket** / bottle

Calculations:

- Weight if the mass of the rocket is **0.94kg**

  9.2 N

- Total pressure if area of each fin is **2.0 x 10^{-4} m^2** (there are 3 fins)

  1.5x10^4 Pa

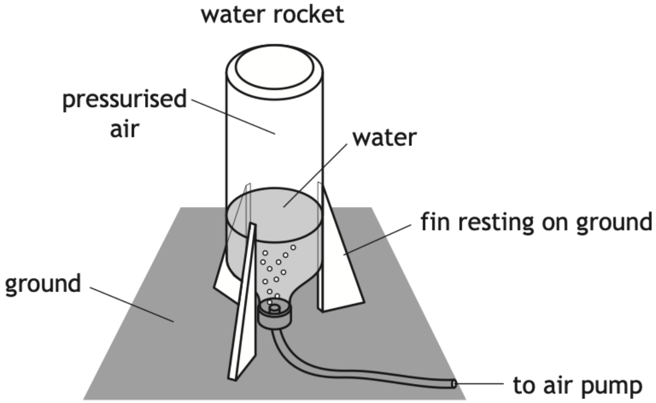
- Initial acceleration if initial upward thrust is **370 N**.

  380 ms^{-2}

Free body diagrams and Newton's Laws

2014 12e

A student is investigating the motion of water rockets.



The student launches the rocket a second time.

For this launch, the student adds a greater volume of water than before. The same initial upward thrust acts on the rocket but it fails to reach the same height.

Explain why the rocket fails to reach the same height. **(2)**

more water will **increase weight**/mass (1)

unbalanced force decreases (1)

acceleration is **less** (1) (Any two from three)

Calculations:

- Weight if the mass of the rocket is **0.94kg**

  9.2 N

- Total pressure if area of each fin is **2.0 x 10^{-4} m^2** (there are 3 fins)

  1.5x10^4 Pa

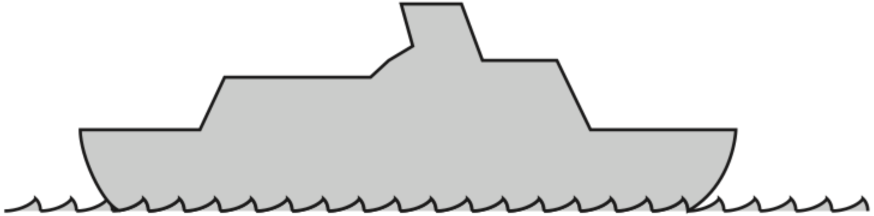
- Initial acceleration if initial upward thrust is **370 N**.

  380 ms^{-2}

Free body diagrams and Newton's Laws

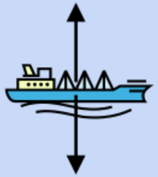
2015 7b

Out in the open sea the ship comes to rest.



Explain, with the aid of a labelled diagram, why the ship floats. **(3)**

buoyancy force/upthrust/force of water on ship/flotation force (1)



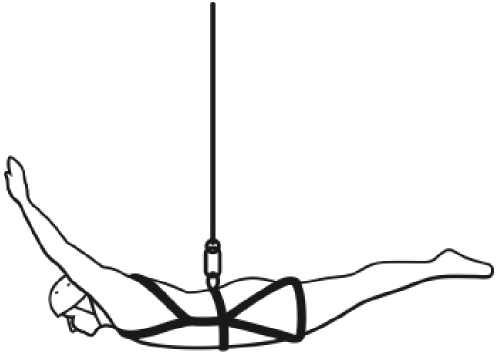
weight/force of gravity (1)

(These) **forces** are **balanced** (1)

Free body diagrams and Newton's Laws

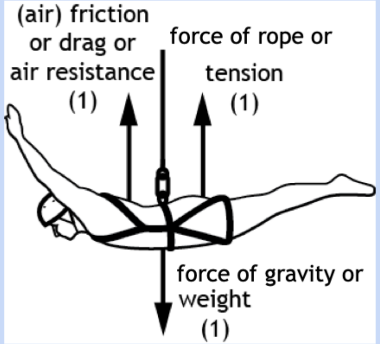
2016 10c

During part of the drop the forces on the climber are balanced.



On the diagram above show all the forces acting vertically on the climber during this part of the drop.

You must name these forces and show their directions. **(3)**



Accept: 'pull of rope' 'gravitational pull' 'pull of gravity'

Do not accept: 'pull/force of air descender' 'gravity' alone 'upward force' alone

Ignore horizontal forces

Free body diagrams and Newton's Laws

2017 9a

A weightlifter applies an upwards force of **1176 N** to a barbell to hold it in a stationary position as shown.

Describe how the upward force exerted by the weightlifter on the barbell compares to the weight of the barbell. **(1)**

(The forces are) **equal** (in size) and **opposite** (in direction).

Calculations:

- mass of barbell. **120 kg**
- initial acceleration if weightlifter increases upward force to **1344N** **1.4 ms^{-2}**

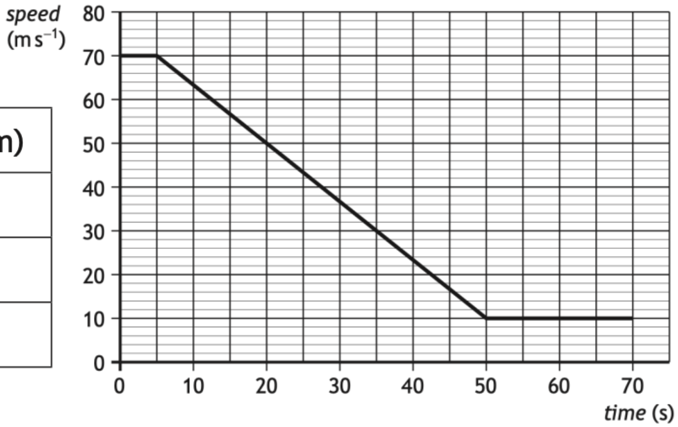
Free body diagrams and Newton's Laws

SPQ 1cii

The aircraft arrives at the destination airport. There are three runways, X, Y and Z, available for the aircraft to land on.

The length of each runway is given in the table.

Runway	*Length* (m)
X	3776
Y	3048
Z	2743



This airport has runways of different lengths to accommodate different sizes of aircraft.

Explain why larger aircraft require a longer runway to land safely. **(2)**

Aircraft has **increased mass (1)**

so has **reduced deceleration (1)**

OR

Aircraft has **increased kinetic energy (1)**

E_w = Fd (so if F is constant d is greater) **(1)**

Calculation:

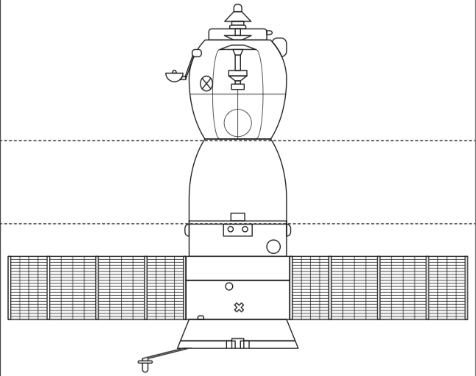
- Which runways could the aircraft safely land on, if the graph on the left shows the speed of the aircraft during landing, from the moment the wheels touchdown?

s = 2350 m so all runways!

Free body diagrams and Newton's Laws

SPQ 2ci

The Soyuz Spacecraft is used to transport astronauts from the International Space Station (ISS) to Earth.



Part	*Mass* (kg)
Orbital Module	1300
Descent Module (including astronauts)	2950
Instrumentation/ Propulsion Module	2900

After the Descent Module has re-entered the atmosphere, its speed is dramatically reduced. Four parachutes are used to slow the Module's rate of descent.

Explain, in terms of forces, how the parachutes reduce the speed of the Module. **(2)**

Upward force is **increased** (by parachutes) **(1)**

producing an **unbalanced force upwards (1)**

Calculations:

- find the initial acceleration assuming the upward force of the propulsion module is **1430N**

0.2 ms^{-2}

Free body diagrams and Newton’s Laws

2019 1d

A quadcopter is a drone with four rotating blades.

The quadcopter hovers at a constant height.

Describe how the overall lift force provided by the four rotating blades compares to the weight of the quadcopter **(1)**

(The forces are) **equal** (in size) and **opposite** (in direction).

Calculations:

- Lots!
- Try the whole question relating to distance/displacement speed and velocity!

Free body diagrams and Newton's Laws

2023 2ci

At another point in the race, the cyclist rides behind their team-mate along a straight, flat section of road.

Explain, in terms of the forces acting on the cyclist, the advantage of cycling behind a team-mate. **(1)**

reduces friction/**air resistance**

Accept: wind resistance

Do not accept: no friction/no air resistance 'slipstreaming' alone 'resistance' alone

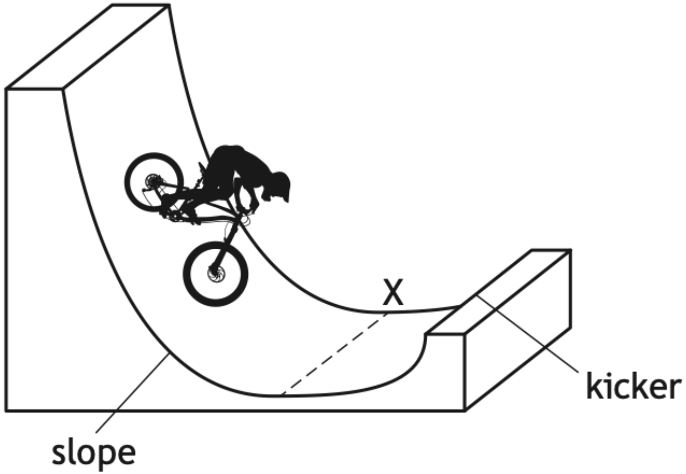
Calculation:
If the cyclist (+ bike) have a combined mass of **74kg**, the forward force is **54 N** and the frictional force is **22 N**, determine **acceleration** of cyclist.

0.43 ms^{-2}

Energy loses (energy conservation)

2018 3bii

During a BMX competition, a cyclist freewheels down a slope and up a 'kicker' to complete a vertical jump.



The cyclist and bike have a combined mass of **75 kg**.
At point X the cyclist and bike have a speed of **8·0 m s^{-1}**.

Explain why the actual height of the jump above point X would be less than the calculated height **(1)**

Energy lost (as heat and sound) due to **friction/air resistance**

Calculations:

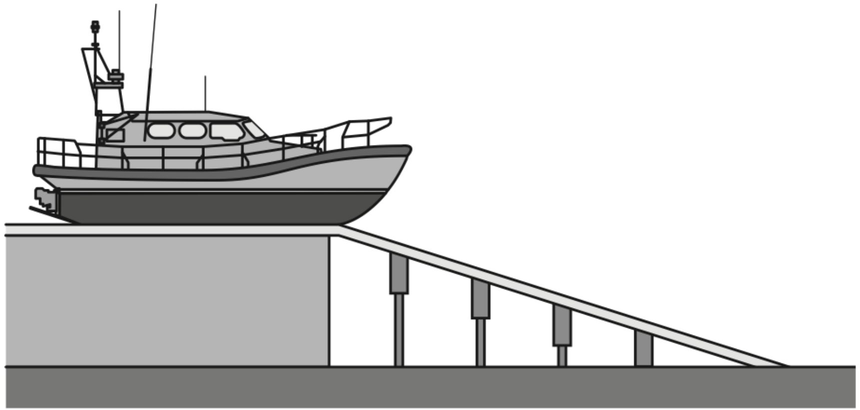
- E_k at point X — **2400 J**
- Maximum jump height above X — **3·3 m**

Relationship sheet

Energy loses (energy conservation)

2019 9cii

The lifeboat has a mass of **25 000 kg**. When it is launched, it loses **$4{\cdot}5 \times 10^5$ J** of gravitational potential energy before it enters the water.



Explain why, in practice, the speed of the lifeboat as it enters the water is less than calculated **(1)**

__energy__ is lost (as heat and sound) due to friction/air resistance

Calculations:

- maximum speed of lifeboat as it enters the water

$6{\cdot}0$ ms^{-1}

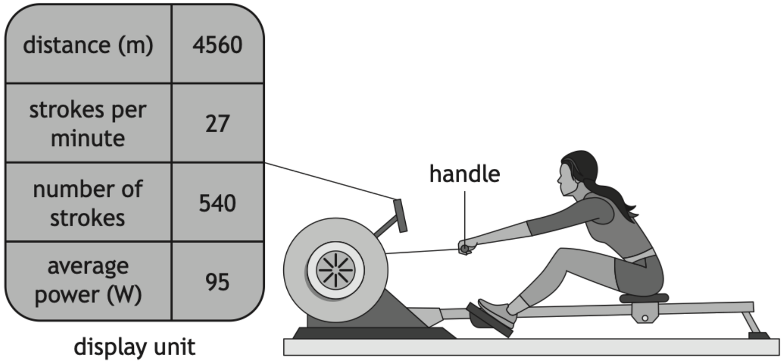
Energy loses (energy conservation)

2020 3bii

An athlete is training on a rowing machine.

Each movement back and forward on the machine is known as a stroke.

The display unit on the machine shows data about the training session.



Explain why, during this time, the athlete produces more energy than that calculated **(1)**

Energy will also have been generated as heat/sound

Accept: Energy is lost to the surroundings

Heat energy produced due to friction or similar

Calculations:

- frequency of stroke

  0·45 Hz

- energy transferred to machine by athlete in **1200 s**

  1.1 x 10^5 J

- If athlete pulls handle back **1.3 m** and transfers **208 J** to machine, what is average force exerted

  160 N

Energy loses (energy conservation)

2023 1ciii

A seagull flies above a school playground. The seagull flies at a height of **7.5 m** above the ground, holding a chip in its beak.

The mass of the chip is **0.0025 kg**.

Explain why, in practice, the vertical speed of the chip as it reaches the ground is less than calculated **(1)**

energy lost (as heat) due to air resistance/friction

Do not accept:

energy lost alone

air resistance/friction alone

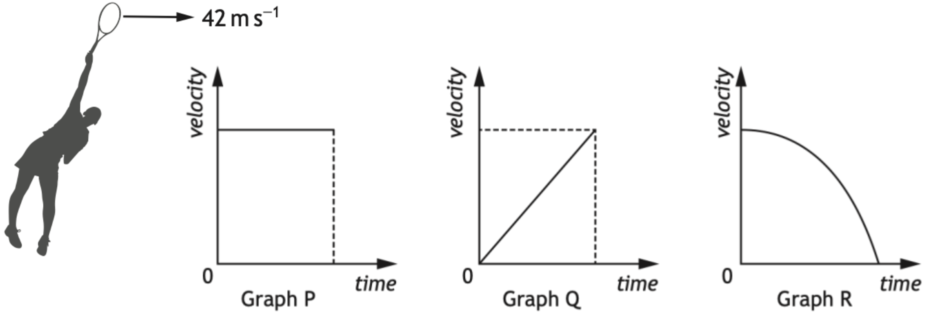
Calculations:

- gravitational potential energy of chip at **7.5** m **0.18 J**
- maximum vertical speed of chip as it reaches the ground **12 ms^{-1}**

Projectile motion

2017 11bi

A tennis player serves a tennis ball horizontally at a velocity of **42 ms^{-1}**.



In a second serve the player hits the ball horizontally with a smaller velocity from the same height.

State whether the time taken for the ball to reach the ground is less than, equal to, or greater than the time taken in the first serve.

Justify your answer. **(2)**

equal (to) (1)

vertical/downward **acceleration** is the **same** (1)

Calculations:

- Which graph shows the vertical velocity of ball

Q

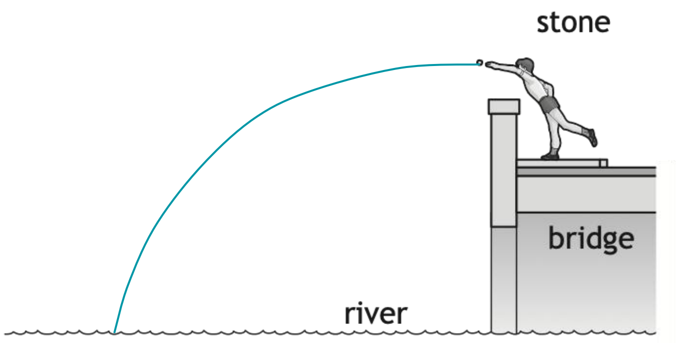
- Moving a section of a retractable tennis court roof **25 m** requires **5.5 kJ** of energy. What is the average force acting on this section of roof?

220 N

Projectile motion

2015 Q9a

A child throws a stone horizontally from a bridge into a river.



On the above diagram sketch the path taken by the stone between leaving the child's hand and hitting the water. **(1)**

suitable **curved path** (1)

Do not accept an indication of stone rising

Stone must hit the water

Calculate:

- vertical velocity if stone takes **0.80 s** to reach water

  7.8 ms^{-1}

- height above the water at which stone was released

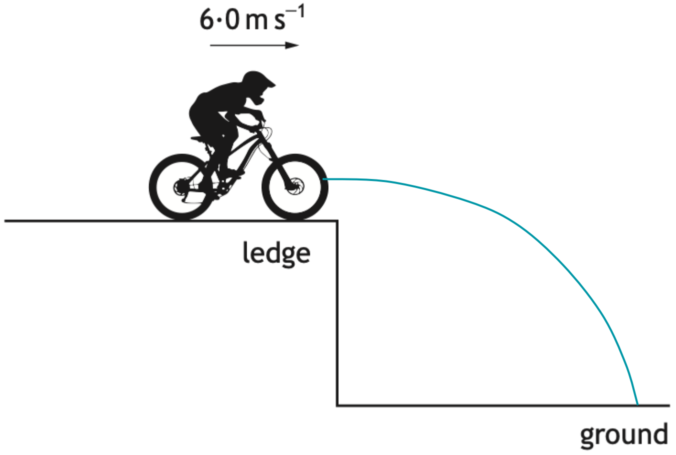
  3.1m

Relationship sheet

Projectile motion

2015 Q9a

During another part of the competition, the cyclist and bike travel horizontally at **6.0 ms^{-1}** off a ledge as shown.



On the diagram above, sketch the path taken by the cyclist and bike between leaving the ledge and reaching the ground. **(1)**

curved path (1)

Do not accept an indication of competitor and bike rising.

Bike **must reach** the ground

Calculate:

- the vertical velocity of the cyclist and bike as they reach the ground, if it takes **0.40 s** to reach ground after leaving ledge

3.9 ms^{-1}

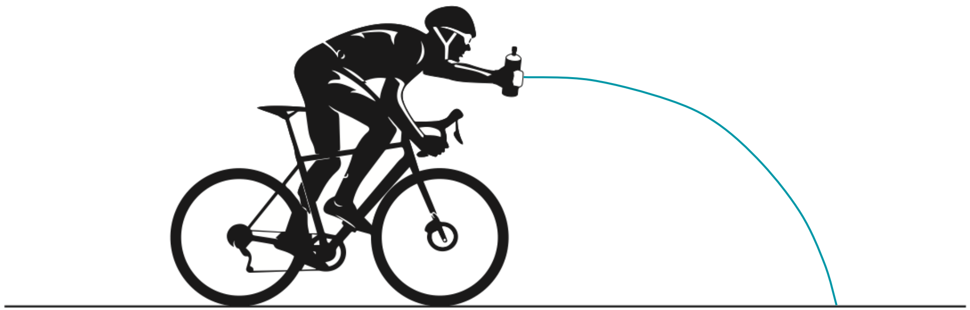
Relationship sheet

Projectile motion

2023 Q2a

During a cycle race, a cyclist attempts to pass a water bottle to a team-mate. The cyclist is travelling in a straight line at **12.5 ms^{-1}** when they drop the bottle. The bottle hits the ground **0.53 s** later.

A spectator at the side of the road observes the cyclist dropping the bottle.



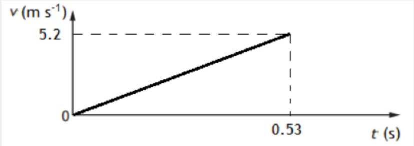
On the diagram above, sketch the path taken by the bottle from the point it is dropped, as observed by the spectator at the side of the road. **(1)**

curved path (1)

Do not accept indication of curve rising above horizontal. Bottle must reach the ground

Calculate:

- the vertical velocity of the bottle as it hits the ground **5.2 ms^{-1}**
- sketch a velocity-time graph for the vertical velocity



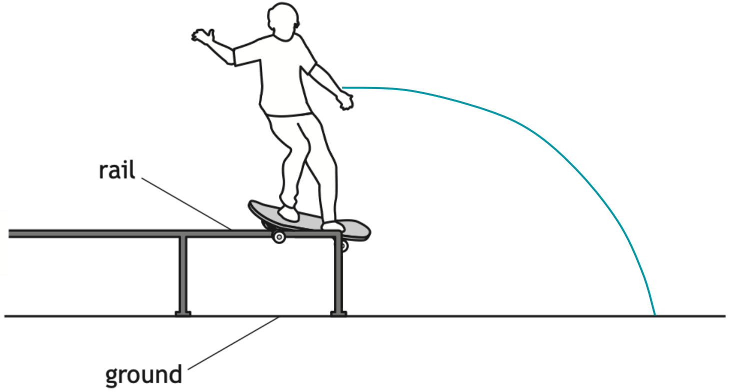
- determine the height from which the bottle was dropped **1.4 m**

Projectile motion

2024 Q3b

A boardslide is a common trick where a skateboarder uses the middle of the skateboard to slide along a horizontal rail. The skateboarder and board have a combined mass of **65 kg**.

The skateboarder and board slide off the end of the rail.



On the diagram, sketch the path of the skateboarder and board between leaving the rail and reaching the ground. **(1)**

curved path (1)

Do not accept indication of curve rising above horizontal. Curve must reach the ground.

Calculate:

- the decrease in kinetic energy of the skateboarder sliding along the rail, before they slide off the end.
  - at start of rail, speed = **7.0 ms^{-1}**
  - at end of rail, speed = **3.0 ms^{-1}**

1300 J

- Average force of friction if rail is **2.0 m** long.

650 N

N5 Physics Revision

Past paper selector

Questions on required **experiments** (descriptions and improvements)

Questions that require **explanations**

Suggestions for **Open Ended Questions**

Questions that require **drawing graphs**

Questions on **unfamiliar Physics**

Questions that require **drawing sketches**

← Back to **Dynamics (explanation)** questions

Relationships sheet

Dynamics

$d = vt$

$F = ma$

$d = \bar{v}t$

$W = mg$

$s = vt$

$E_w = Fd$

$s = \bar{v}t$

$E_p = mgh$

$a = \frac{v-u}{t}$

$E_k = \frac{1}{2}mv^2$

Electricity

$Q = It$

$P = \frac{E}{t}$

$V = IR$

$V_2 = \left(\frac{R_2}{R_1+R_2}\right)V_S$

$P = IV$

$P = I^2R$

$\frac{V_1}{V_2} = \frac{R_1}{R_2}$

$P = \frac{V^2}{R}$

$R_T = R_1 + R_2 + ...$

$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + ...$

Properties of matter

$E_h = cm\Delta T$

$p_1V_1 = p_2V_2$

$E_h = ml$

$\frac{p_1}{T_1} = \frac{p_2}{T_2}$

$p = \frac{F}{A}$

$\frac{V_1}{T_1} = \frac{V_2}{T_2}$

$\frac{pV}{T} = \text{constant}$

Radioactivity

$A = \frac{N}{t}$

$H = Dw_r$

$D = \frac{E}{m}$

$\dot{H} = \frac{H}{t}$

Waves

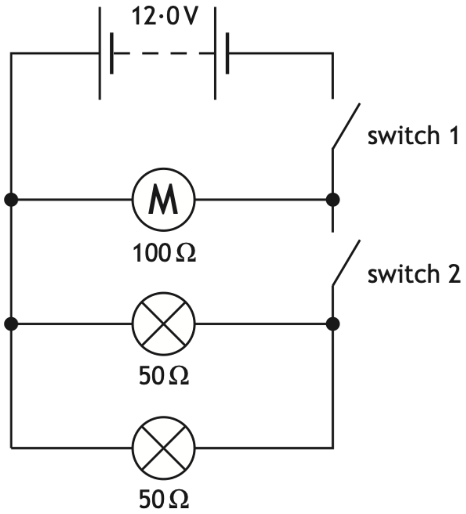
$f = \frac{N}{t}$

$v = f\lambda$

$T = \frac{1}{f}$

Switches

2014 1bii



One of the lamps now develops a fault and stops working. State the effect this has on the other lamp.

You must justify your answer. **(2)**

Effect:
The other lamp stays on **(1)**
OR is the same brightness

Justification:
The current still has a path through the other lamp. **(1)**

OR

The current in the other lamp is the same (assuming the brightness is the same is the first mark response)**(1)**

OR

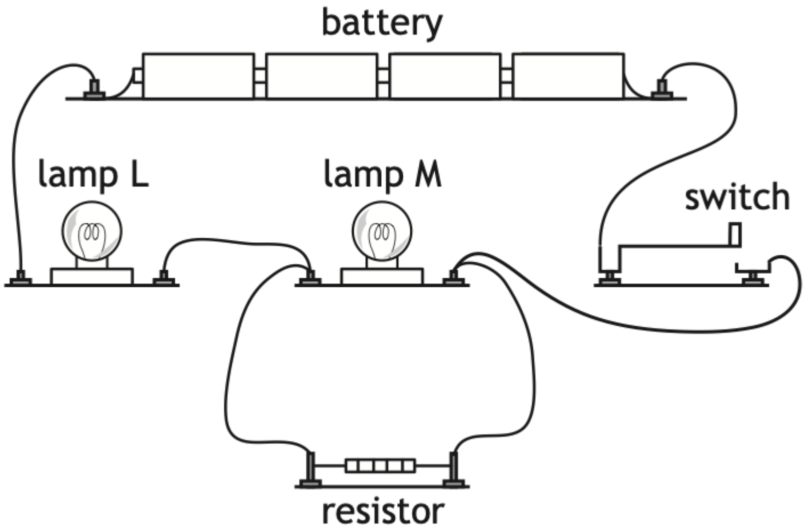
It has the same voltage / 12 V (across it) **(1)**

Calculations:

- Power in motor **1.44 W**
- Total resistance **20 Ω**

Switches

2015 1c



When the switch is closed, will lamp L be brighter, dimmer or the same brightness as lamp M?

You must justify your answer. **(3)**

Effect:
Lamp L is brighter **(1)**

Justification:
M is in parallel **(1)**
Greater current in/through lamp L **(1)**

Effect:
Lamp L brighter **(1)**

Justification:
M is in parallel **(1)**
Greater voltage across lamp L **(1)**

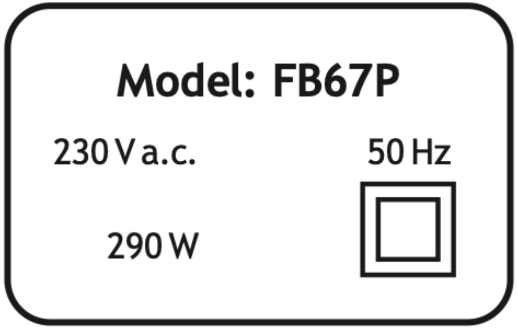
Calculations:
Find the resistance of the lamp
(when V = **2.5V** and I = **0.50A**)

5 Ω

AC/DC

2017 1b

The rating plate on a food blender is shown.



The blender is connected to an alternating current (a.c.) supply.

Explain in terms of electron flow what is meant by *alternating current*. **(1)**

direction of **electron** (flow) is

(continually)

changing back and forth

OR

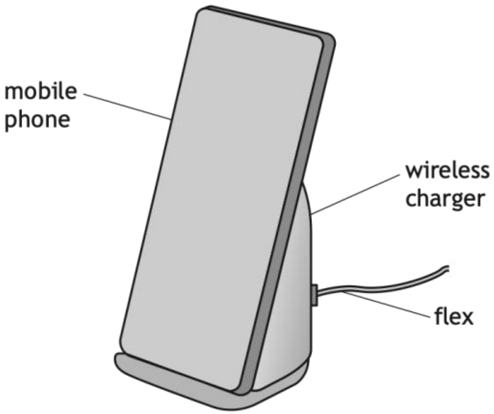
moving to and fro

Calculations:
Determine the rating of the fuse required.

3A fuse required, as I = 1.3 A

AC/DC

2024 7a



The charger is connected to a direct current (d.c.) supply via a flex.

Explain in terms of electron flow what is meant by direct current. **(1)**

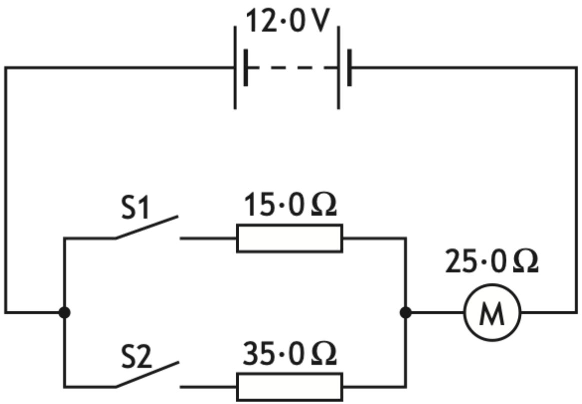
Electrons move in **one direction** (only).

Calculations:
Charge supplied when I = **2.5 A** and time =**1.5 hours**

14000 C

Electrical power

2017 2bii



Switch 1 is already closed.

State the effect that closing switch S2 has on the power dissipated in the motor.

Justify your answer. **(3)**

Power dissipated is **greater (1)**

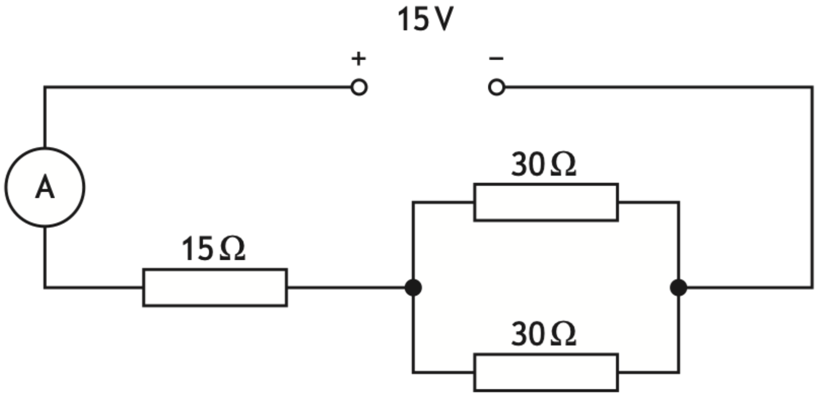
when connected in parallel, total resistance is less **(1)**

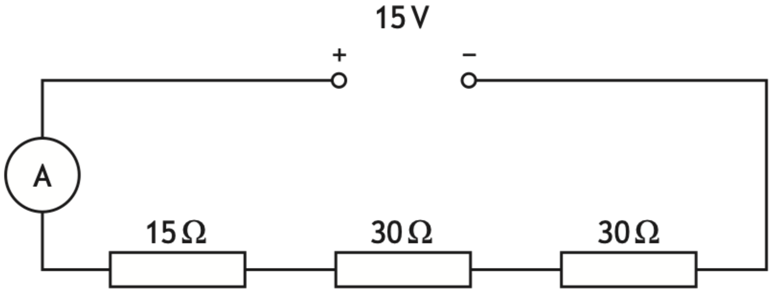
current (<u>in motor</u>) is **greater**
OR
voltage <u>across</u> motor is **greater (1)**

Calculations:

- Voltage across motor when S1 closed **7.50 V**
- Power dissipated in motor **2.25 W**
- Total resistance when S2 closed **10.5 Ω**

Electrical power





SPQ 5b

State how the power dissipated in the **15 Ω** resistor when connected in the top circuit compares to when it is connected in the bottom circuit.

You **must** justify your answer. **(3)**

Power dissipated is **greater (1)**

The **total resistance** of the circuit is now **less (1)**

The **current** in the circuit is now **greater (1)**

Calculations:

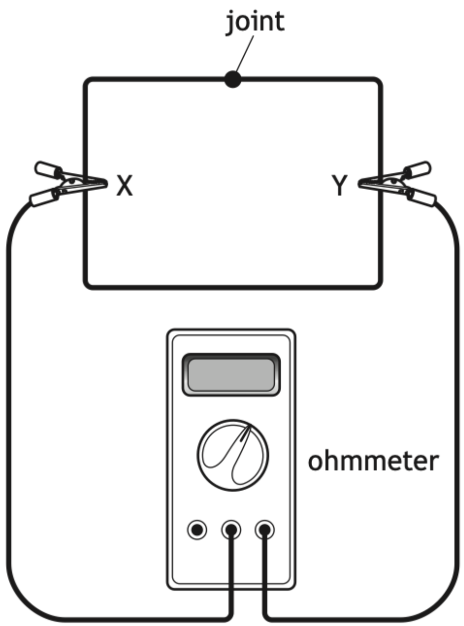
- Total resistance in the series circuit. **75 Ω**
- Current in the series circuit **0.20 A**
- Power dissipated in **15 Ω** resistor when in the series circuit **0.60 W**

Resistors

2019 5b

A length of the wire with a resistance of 5·2 Ω is folded into a rectangular shape and the ends are joined together.

An ohmmeter is connected across the wire between point X and point Y as shown.



State whether the reading on the ohmmeter would be less than, equal to or greater than 5·2 Ω.

You must justify your answer. **(2)**

Resistance will be **less** (than 5·2 Ω) **(1)**

(**The wire** now **has**) **shorter length** (between X and Y)

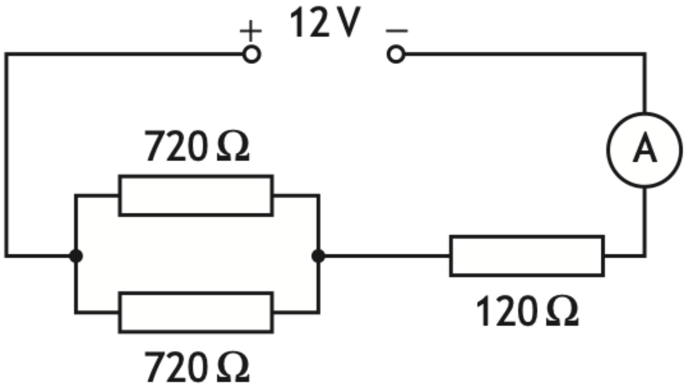
OR

(**Two wires** are) **connected** in **parallel** **(1)**

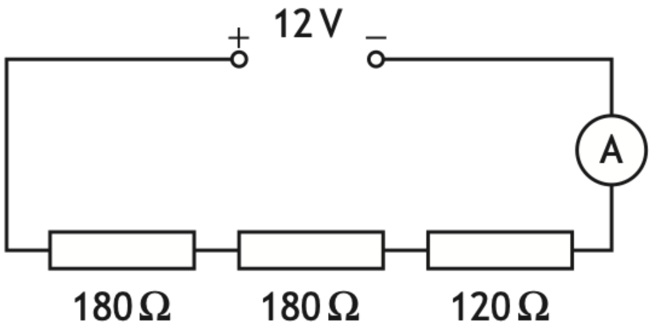
Electrical power

2019 6bii

Circuit A



Circuit B



State how the power dissipated in the **120 Ω** resistor in **circuit A** compares to when it is connected in **circuit B**.

You **must** justify your answer. **(2)**

Power will be the **same** (1)

Current in the 120 Ω resistor will be the **same** (1)

OR

Voltage across the 120 Ω resistor will be the **same**.

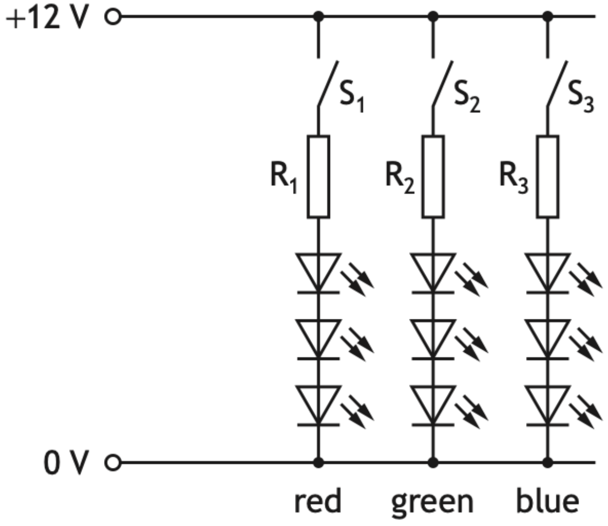
Calculations:

- Total resistance of the series circuit. **480 Ω**
- Current in the series circuit **0.025 A**
- Power dissipated in **120 Ω** resistor when connected in series **0.075 W**

Relationship sheet

Resistors

2020 6ai



State the purpose of the resistor connected in series with the LEDs. **(1)**

To **reduce**/limit the **current** (in the LEDs)

Accept:

To **reduce** the **voltage** across the LEDs

OR

Protect/prevent damage to the **LEDs**.

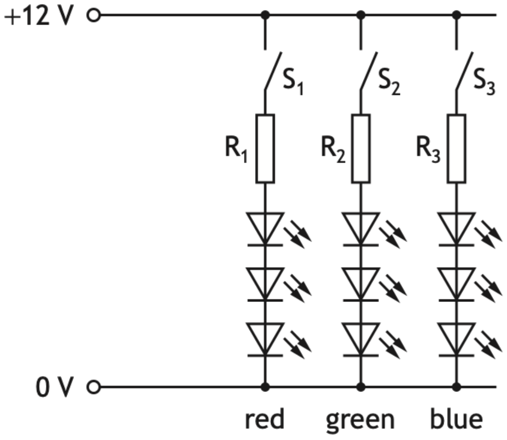
Calculations:
Each red LED operates at a voltage of **1·8 V** and a current of **0·020 A**

- Calculate the resistance of R_1

330 Ω

Switches

2020 6b



All three switches are closed.

State whether the red LEDs will be brighter, dimmer or the same brightness compared to when only S1 is closed.

You must justify your answer. **(2)**

same brightness **(1)**

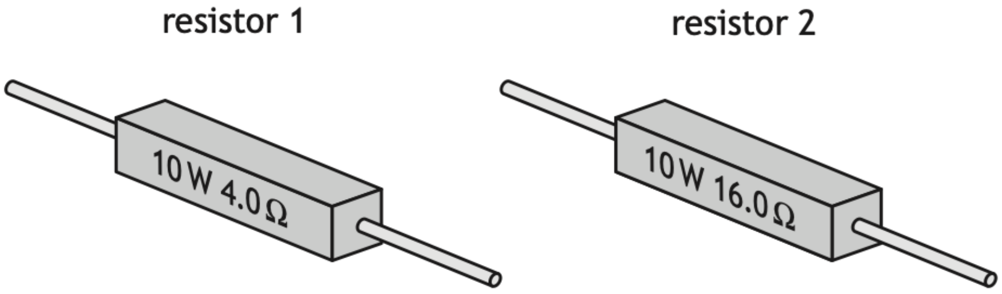
same voltage across the red LEDs

OR

the three branches are connected in **parallel**, so **voltage** across them **does not change (1)**

Resistors

2022 6cii



State which of the two resistors will allow the greater current to pass.

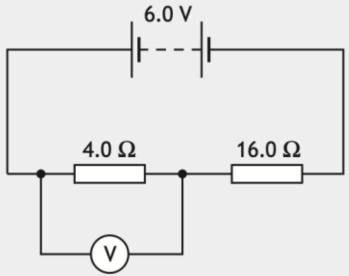
You must justify your answer. **(2)**

Resistor 1 (1)

Lower resistance (therefore greater current) **(1)**

Calculations:

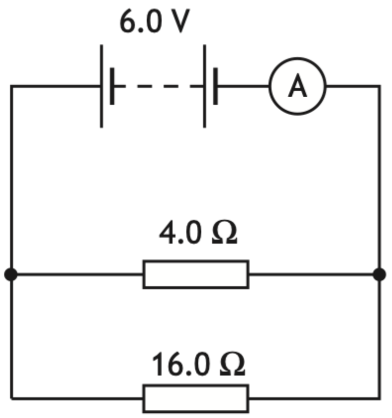
- Reading on voltmeter



1.2 V

Resistors

2022 6cii



Another ceramic power resistor is now connected in parallel with the two resistors shown in the circuit.

State the effect this change has on the reading on the ammeter.

Justify your answer. **(2)**

Reading on **ammeter increases** (1)

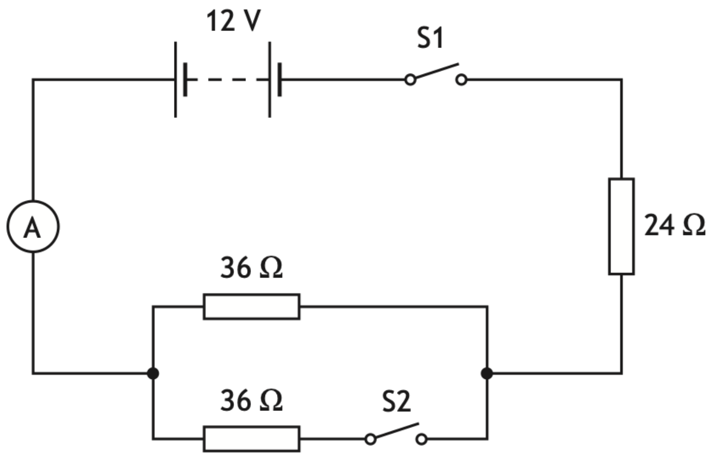
Total resistance decreases (1)

Calculations:
Total resistance of the parallel circuit

3.2 Ω

Switches

2023 6bii



Switch S1 is closed.

Switch S2 is then closed.

State whether the reading on the ammeter will now be less than, equal to or greater than the value when just switch S1 is closed.

You must justify your answer. **(2)**

Ammeter reading will be **greater** (1)

Total circuit **resistance** will be **less** (1)

Calculations:

- Ammeter reading when S1 is closed. **0.20 A**
- Total resistance when S1 and S2 are closed. **42 Ω**

N5 Physics Revision

Past paper selector

Questions on required **experiments** (descriptions and improvements)

Questions that require **explanations**

Suggestions for **Open Ended Questions**

Questions that require **drawing graphs**

Questions on **unfamiliar Physics**

Questions that require **drawing sketches**

← Back to **Radiation (explanation)** questions

Relationships sheet

Dynamics

$d = vt$

$F = ma$

$d = \bar{v}t$

$W = mg$

$s = vt$

$E_w = Fd$

$s = \bar{v}t$

$E_p = mgh$

$a = \frac{v-u}{t}$

$E_k = \frac{1}{2}mv^2$

Electricity

$Q = It$

$P = \frac{E}{t}$

$V = IR$

$V_2 = \left(\frac{R_2}{R_1 + R_2}\right)V_S$

$P = IV$

$P = I^2R$

$\frac{V_1}{V_2} = \frac{R_1}{R_2}$

$P = \frac{V^2}{R}$

$R_T = R_1 + R_2 + ...$

$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + ...$

Properties of matter

$E_h = cm\Delta T$

$p_1V_1 = p_2V_2$

$E_h = ml$

$\frac{p_1}{T_1} = \frac{p_2}{T_2}$

$p = \frac{F}{A}$

$\frac{V_1}{T_1} = \frac{V_2}{T_2}$

$\frac{pV}{T} = \text{constant}$

Radioactivity

$A = \frac{N}{t}$

$H = Dw_r$

$D = \frac{E}{m}$

$\dot{H} = \frac{H}{t}$

Waves

$f = \frac{N}{t}$

$v = f\lambda$

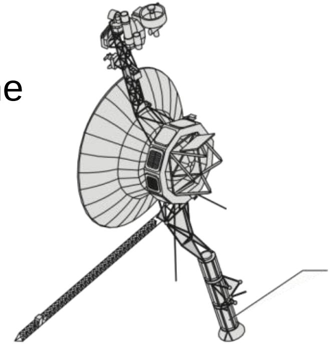
$T = \frac{1}{f}$

Nature of radiation...

2016 Q7c

A spacecraft uses a radioisotope thermoelectric generator (RTG) as a power source.

The RTG transforms the heat released by plutonium–238 into electrical energy.



Plutonium-238 emits alpha radiation.

Explain why a source that emits alpha radiation requires less shielding than a source that emits gamma radiation. **(1)**

Any one of:

(Alpha is) **more easily absorbed**/stopped/blocked

(Alpha) is **absorbed** by **thinner materials/**less dense materials.

Gamma is **absorbed** by **thicker materials/**more dense materials.

(**Alpha**) is **less penetrating** (than gamma).

Gamma is **more penetrating** (than alpha)

Calculate:

- the activity, if **7.92×10^{18}** nuclei decay in **15 minutes**.
  8.8×10^{-15} Bq
- the power output if one decay produces heat that is transformed into **4.49×10^{-14} J** of electrical energy.
  400 W

Nature of radiation...

SPQ 12c

A worker in the radiation industry uses a radioactive source to investigate the effect of gamma rays on biological tissue.

(a) State what is meant by the term gamma rays. **(1)**

(c) The radioactive source must be stored in a lead-lined container.

Explain why a lead-lined container should be used. **(1)**

(a) **High frequency** (or short wavelength) **electromagnetic** radiation

(c) **Lead** can **absorb** (some of) the **gamma** rays

Calculate:

- the energy absorbed by a tissue sample if..
  - the mass of tissue is **0.10 kg**
  - the absorbed dose is **50 μGy**.

5.0×10^{-6} J

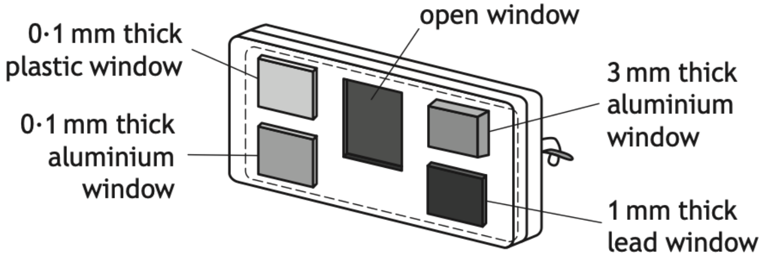
Relationship sheet

Nature of radiation...

2019 12d

The technician wears a film badge to monitor exposure to radiation.

The film badge contains a piece of photographic film behind windows of different materials.



Explain how this badge is used to determine the type of radiation the technician has been exposed to. **(2)**

(Photographic) **film blackened**/ darkened/fogged (1)

(Film behind) **different windows** affected by **different types** of **radiation** (1)

Calculate:

- the absorbed dose received by technician if
  - the mass of technician is **80.0 kg**
  - the energy absorbed is **1.2 μJ**.

1.5×10^{-8} Gy

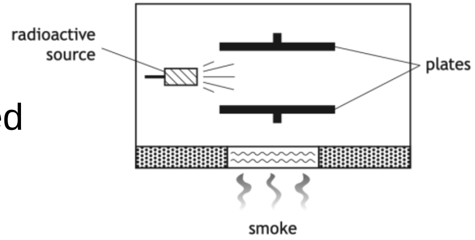
- the radiation weighting factor of source if
  - the technician receives an equivalent dose of **4.5×10^{-8} Sv**.

$\omega_R = 3$

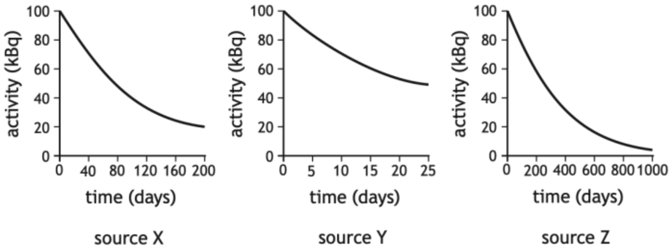
Nature of radiation…

2022 13a,bii

Smoke detectors are designed to automatically detect smoke and give a warning. It is recommended that smoke detectors are replaced every ten years.



Inside the smoke detector a radioactive source causes ionisation of the air between two electrically charged plates. When smoke enters the detector, the ionisation of the air is reduced. The graphs show how the activity of three different alpha sources X, Y, and Z change with time.



In most smoke detectors the radioactive source used is americium-241, which emits alpha particles.

(a) Give two reasons why an alpha radiation source is used rather than a beta or gamma source. **(2)**

(b) Explain why these sources would not be suitable for use in a smoke detector. **(2)**

(a) **Alpha** is (more easily) **absorbed** by **air**/smoke/detector

OR Alpha has a **short**(er) **range** in air **(1)**

Alpha is the **most ionising (1)**

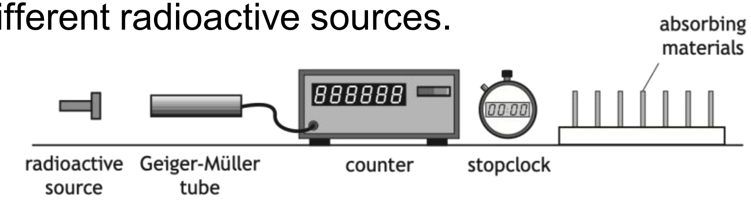
(b) The **half-life** of the sources are **too short (1)**

The **smoke detectors** would **only work** for a **short time**/need to be replaced frequently/would not last 10 years. **(1)**

Nature of radiation…

2023 13a

An experiment is carried out, using the apparatus shown, to investigate the radiation emitted from different radioactive sources.



Different absorbing materials are placed, in turn, between the radioactive source and the Geiger-Müller tube, and the count rate is determined. This procedure is repeated for each radioactive source.

Radioactive source	Count rate (counts per minute)			
	No absorbing material	Sheet of paper	3 mm thickness of aluminium	8 mm thickness of lead
X	540	542	539	380
Y	823	350	354	171
Z	652	649	12	14

One of the sources emits beta radiation only, one emits gamma radiation only, and one emits both alpha and gamma radiation.

State which source, X, Y or Z, emits both alpha and gamma radiation. Justify your answer. **(3)**

Y **(1)**

Sheet of paper absorbs alpha radiation, (reducing the count rate). **(1)**

(8 mm of) lead absorbs (some of the) gamma radiation, (reducing the count rate further).

OR (Some) gamma radiation is able to penetrate (8 mm of) lead

OR The gamma radiation is able to penetrate the (3mm of) aluminium

OR (Source) Y is the only source with a (significant) reduction in count rate due to paper **(1)**

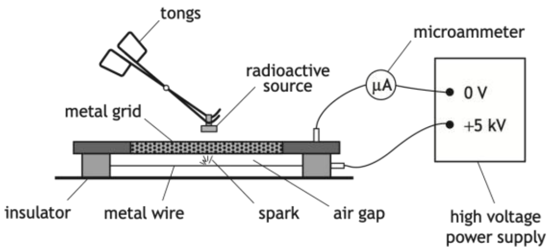
Nature of radiation…

2023 13bii

A second experiment is carried out to investigate the ionising effect of radiation.

A radioactive source is held close to a spark counter. The spark counter consists of a metal wire connected to a microammeter and a high voltage power supply as shown.

The radioactive source used in this experiment emits alpha and gamma radiation.



A radioactive source is placed close to the metal grid.

Radiation from the source ionises the air between the metal wire and the grid. Sparks are produced between the wire and the grid.

Distance between the source and metal grid (mm)	Observation
10	continuous sparking
30	few sparks
60	no sparks

State what is meant by the term ionisation. **(1)**

When an (uncharged) **atom gains** or **loses** an **electron**(s).

OR When an (uncharged) atom gains an electron(s).

OR When an (uncharged) atom loses an electron(s).

Using information from the table, state which type of radiation emitted from the source is causing the air between the wire and metal grid to be ionised.

You must justify your answer. **(2)**

alpha (radiation) (1)

Alpha radiation only has a **short range** (in air)

OR Fewer alpha particles would **reach the spark counter** at **increased distance**. (1)

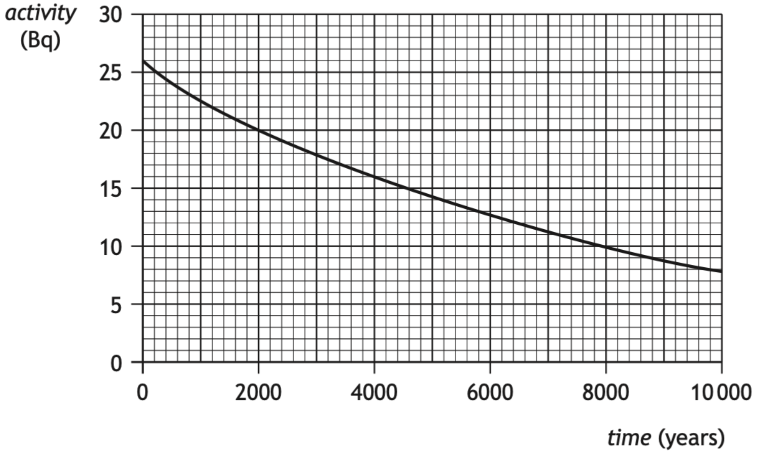
Relationship sheet

Half life

SPQ 11b

Trees continually absorb carbon-14 when they are alive. When a tree dies the carbon-14 contained in its wood is not replaced. Carbon-14 is radioactive and decays by beta emission.

Following the tree's death, the activity of the carbon-14 within a **25 mg** sample of its wood changes as shown.



First, calculate:

- using the graph, the half-life of carbon-14.

5800 ± 100 years

- the time taken for the activity of the sample to fall to 6.5 Bq

t = 10 600 years

- estimate the age of a 125 mg sample of the same wood, where the activity was 40 Bq.

9700 ± 100 years

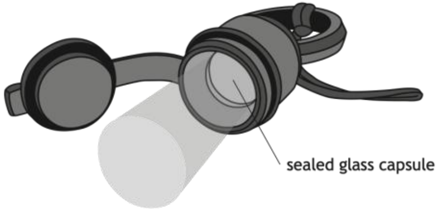
Now, explain why this method could not be used to estimate the age of a tree that died 100 years ago. **(1)**

The **activity** (of a sample from the tree) would not have **reduced significantly**/ measurably in **100 years**

Half life

2018 12b

A tritium torch includes a sealed glass capsule containing radioactive tritium gas.



Beta particles emitted by the tritium gas are absorbed by a coating on the inside of the glass capsule.

The coating then emits visible light.

(a) State what is meant by a beta particle. **(1)**

(b) The half-life of tritium gas is **12·3 years.**

The manufacturer states that the torch will work effectively for **15 years**. Explain why the torch will be less effective after this time. **(2)**

(a) **Fast**/high-energy **electron** (1)

(b) **Activity** of tritium source is **less**/ **fewer beta** particles **emitted** per **second**. (1)

Less light produced (1)

Also, calculate:

- the energy absorbed by radiation worker if…
  - their mass is 85 kg
  - their absorbed dose is 0.40 mGy

0.034 J

- the equivalent dose received by the worker

4.0 x 10^{-4} Sv

Fission and fusion

2016 13a

Supernova explosion

The average temperature of the surface of the Sun is **5778 K**. In the core of the Sun energy is produced by nuclear fusion. Once the Sun has used all its nuclear fuel it will collapse to form a white dwarf.

A star with a mass much larger than that of the Sun will end its life in an enormous explosion called a supernova. The energy released in a supernova explosion is more than a hundred times the energy that the Sun will radiate over its entire **10 billion year** lifetime.

In our galaxy, the star Betelgeuse is predicted to explode in a supernova. Betelgeuse has a mass of around 8 times the mass of the Sun. Even though Betelgeuse is **640 light-years** from Earth, the supernova will be as bright as a full moon at night in our sky.

State what is meant by the term nuclear fusion. **(1)**

(Two) nuclei combine (to form a larger nucleus). **(1)**

Also, calculate:

- the average temperature of the Sun in °C

  5505 (°C)

- the distance from Earth to Betelgeuse in metres

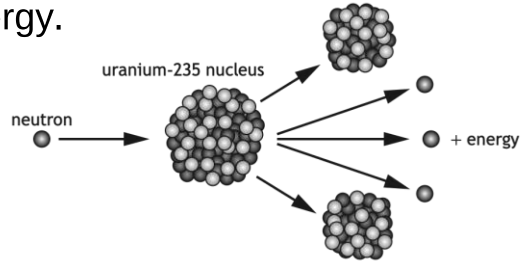
  6.1×10^{18} m

Relationship sheet

Fission and fusion

2017 Q7b

In a nuclear reaction a uranium-235 nucleus is split by a neutron to produce two smaller nuclei, three neutrons, and energy.



The fuel for the power station is in the form of pellets, containing uranium-235.

A fuel pellet has an activity of **80 kBq**.

(a) State what is meant by an activity of **80 kBq**. **(1)**

(b) Explain how a single reaction can lead to the continuous generation of energy. **(2)**

(c) The nuclear reactor produces waste that emits nuclear radiation.State a use of nuclear radiation. **(1)**

(a) **80 000** (nuclei) **decay**(s) per **unit time (1)**

(b) **neutrons** can go on to **cause further** (**fission**) **reactions/split** more (uranium) **nuclei (1)**
causing a **chain reaction**/this **process repeats (1)**

(a) any suitable use (eg **treating cancer/tracers/ sterilisation/smoke detectors/ measuring thickness** of **paper**) **(1)**

Also, calculate:

- the power output of a reactor if
  - one reaction releases **3.2×10^{-11} J**
  - there are **3.0×10^{21}** reactions each **minute**

1.6×10^9 W

Relationship sheet

Fission and fusion

2020 13a

In a nuclear power station, nuclear reactions are used to generate electrical energy.

In a nuclear reaction a uranium nucleus is split by a neutron to produce two smaller nuclei, two or three neutrons and energy.

(i) State the name given to this type of nuclear reaction. **(1)**

(ii) Explain how a single reaction can lead to the continuous generation of energy. **(2)**

i. (induced nuclear) **fission (1)**

ii. The **neutrons** produced in **first reaction** can **go on** to **cause further reactions**/split more nuclei **(1)**

this **process repeats**/a **chain reaction** occurs. **(1)**

Also, calculate:

- the time for activity of nuclear waste to drop to **1/32** of its original value if half-life is **32 years**.

  96 years

- the equivalent dose of worker receives
  - **2·2 μGy** of slow neutrons
  - **3·4 μGy** of gamma radiation

  $1{\cdot}0 \times 10^{-5}$ Sv

- number of shifts it would take for worker to receive **20 mSv**.

  2000 shifts

Relationship sheet

Fission and fusion

2022 14bii

Nuclear fission is used in nuclear reactors to generate electricity.

Nuclear fusion happens naturally in stars such as the Sun.

Electricity generated from nuclear fission reactions is used to power the engines of an icebreaker ship.

(a) State what is meant by the term nuclear fission. **(1)**

(b) (ii) For many years, scientists have been attempting to develop nuclear fusion reactors. Current fusion reactors can only sustain reactions for a limited period of time.

Describe one difficulty in sustaining nuclear fusion reactions in a reactor. **(1)**

(a) (Nuclear fission is when a large) **nucleus** (of an atom) **splits** (into two or more smaller nuclei). **(1)**

(b) (ii) **Any one of:**

Requires **high temperatures**

Difficult to control/**contain plasma**

Requires **strong magnetic fields**

Also, calculate:

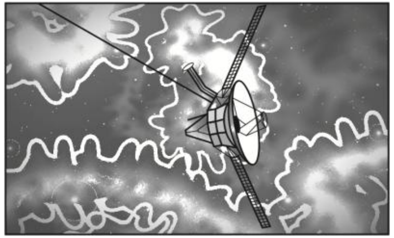
- the minimum number of fission reactions **every hour** if…
  - the power output of the reactor is **150 MW**
  - each nuclear fission reaction releases **2.9×10^{-11} J** of energy

1.9×10^{22}

Fission and fusion

2024 15b,c,d

Read the passage and answer the questions that follow.



Spacecraft travelling to distant parts of the Solar System need to have a source of power to operate their electrical systems.

Many spacecraft use solar cells to generate electricity, but this is not always suitable.

Some spacecraft, such as Voyager 2, are powered using energy generated by Radioisotope Thermoelectric Generators (RTGs). The RTGs in Voyager 2 use plutonium-238 as a fuel. The half-life of plutonium-238 is 88 years. The plutonium decays to uranium in a nuclear fission reaction. The heat generated by this radioactive decay is then converted into electrical energy.

In the future, NASA plans to equip spacecraft with miniature nuclear reactors, which use nuclear fission chain reactions to generate power.

(b) Explain why the decay of plutonium to uranium is described as a nuclear fission reaction.**(1)**

(c) Describe the role of neutrons in a nuclear fission chain reaction. **(2)**

(d) Voyager 2 has been travelling through space for nearly 50 years.

Explain why the power output of the RTGs on Voyager 2 have decreased over this time. **(1)**

(b) (plutonium/large) nucleus splits (into smaller nuclei) **(1)**

(c) The neutrons released from one reaction **(1)**

go on to split other nuclei/cause further fissions **(1)**

(d) The activity (of plutonium) decreases (with time) **(1)**

N5 Physics Revision

Past paper selector

Questions on required **experiments** (descriptions and improvements)

Questions that require **explanations**

Suggestions for **Open Ended Questions**

Questions that require **drawing graphs**

Questions on **unfamiliar Physics**

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← *Back to **Properties of matter (explanation)** questions*

Relationships sheet

Dynamics

$d = vt$

$F = ma$

$d = \bar{v}t$

$W = mg$

$s = vt$

$E_w = Fd$

$s = \bar{v}t$

$E_p = mgh$

$a = \frac{v-u}{t}$

$E_k = \frac{1}{2}mv^2$

Electricity

$Q = It$

$P = \frac{E}{t}$

$V = IR$

$V_2 = \left(\frac{R_2}{R_1 + R_2}\right)V_S$

$P = IV$

$P = I^2R$

$\frac{V_1}{V_2} = \frac{R_1}{R_2}$

$P = \frac{V^2}{R}$

$R_T = R_1 + R_2 + ...$

$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + ...$

Properties of matter

$E_h = cm\Delta T$

$p_1V_1 = p_2V_2$

$E_h = ml$

$\frac{p_1}{T_1} = \frac{p_2}{T_2}$

$p = \frac{F}{A}$

$\frac{V_1}{T_1} = \frac{V_2}{T_2}$

$\frac{pV}{T} = \text{constant}$

Radioactivity

$A = \frac{N}{t}$

$H = Dw_r$

$D = \frac{E}{m}$

$\dot{H} = \frac{H}{t}$

Waves

$f = \frac{N}{t}$

$v = f\lambda$

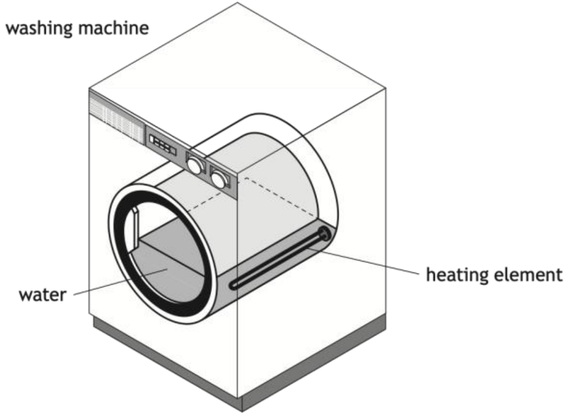
$T = \frac{1}{f}$

Specific heat capacity and latent heat

2016 3bii

A washing machine fills with water at a temperature of **15·0 ºC**.

The water is heated by a heating element.



Explain why, in practice, it takes longer to heat the water from **15 ºC** to **40 ºC** than the theoretical calculated value **(1)**

<u>Heat</u> (energy) is **lost** (from the water) to the washing machine/drum /**surroundings**/clothing

OR

Some of the **energy** is used to **heat** up the **washing machine**/element/drum/clothing

Also, calculate:

- the minimum energy to raise the temperature of the water from **15°C** to **40°C**

  627 000 J

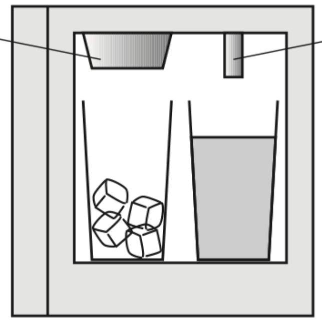
- time time taken for the 1800 W heating element to heat the water

  350 s

Specific heat capacity and latent heat

SPQ Q7cii

A fridge/freezer has water and ice dispensers as shown.



Explain why the actual time taken to make the ice will be longer than the time calculated **(2)**

Heat will be taken in from the **surroundings** (1)

so the system will have **additional heat** to **remove** (1)

Also, calculate:

- the energy removed from **0·100 kg** of water that flows into the freezer at **15·0°C** and cools to **0°C**.

  6270 J

- the energy released from **0·100 kg** of water at **0°C** that changes to ice at **0°C**

  $3{\cdot}34 \times 10^4$ J

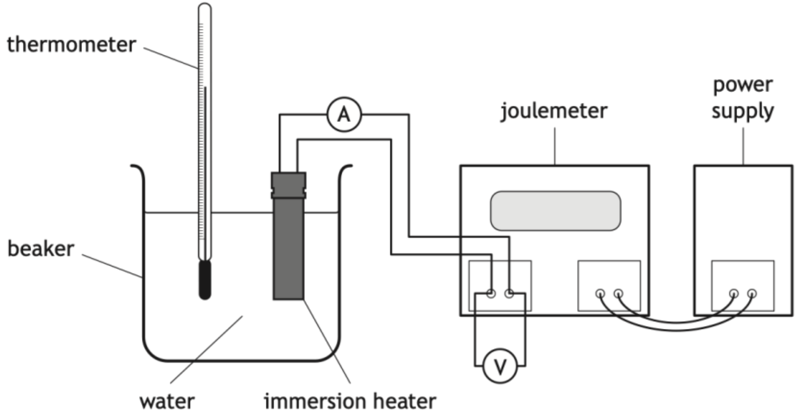
- the minimum time taken to produced **0·100 kg** of ice from **0·100 kg** of water, initially at **15°C**, if the freezer removes heat at a rate of **115 Js^{-1}**.

  345 s

Specific heat capacity and latent heat

2018 Q8aii

A student carries out an experiment, using the apparatus shown, to determine a value for the specific heat capacity of water.



Explain why the value determined from the experiment is different from the value quoted in the data sheet. **(1)**

<u>**Heat**</u> (energy) is **lost** to the **surroundings**/to air.

OR

some of the <u>**heat**</u> (energy) is used to **heat up** the heater/**beaker**.

Also, calculate:

- the specific heat capacity of water if
    - energy supplied by heater = **21 600 J**
    - the mass of water = **0.50 kg**
    - water rises in temp from **16°C** to **24°C**
    - voltmeter = **12V**, ammeter = **4.0 A**

5 400 J kg^{-1} °C^{-1}

- the time for which the immersion heater is switched on in this experiment.

450 s

Relationship sheet

Specific heat capacity and latent heat

2019 Q7biii

A hot water dispenser is used to heat enough water for one cup at a time.

Model: 1-KUPPA
3·5 kW
230 V
50 Hz

The hot water dispenser takes **26 s** to heat enough water for one cup.

Explain why, in practice, the mass of steam produced is less than calculated. **(1)**

<u>Heat</u> (energy) **lost** to the **surroundings**.

OR

Some of the **<u>heat</u>** (energy) is used to **heat** the **dispenser**.

Also, calculate:

- the energy supplied to the hot water during the heating process

  91 000 J

- the minimum energy to heat **0·250 kg** of water from **20·0°C** to boiling point

  83 600 J

- the maximum mass of steam produced while the water for one cup is heated.

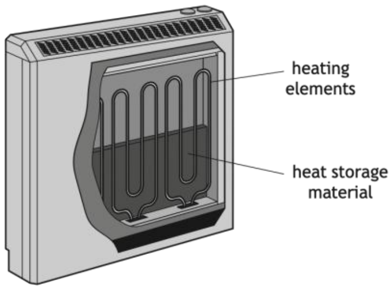
  0·0033 kg

Specific heat capacity and latent heat

2020 Q8c

A storage heater heats a material overnight then allows the material to radiate this heat during the day.

A manufacturer is testing heat storage materials with different specific heat capacities.



In each test the temperature of **2·5 kg** of material is raised from **22 °C** to **250 °C**.

The manufacturer conducts the test using both oil and a clay brick.

State whether the time taken to heat the oil is less than, equal to or greater than the time to heat the clay brick.

Justify your answer. **(2)**

greater time (1)

specific heat capacity (of oil) is **greater** (than clay brick) (1)

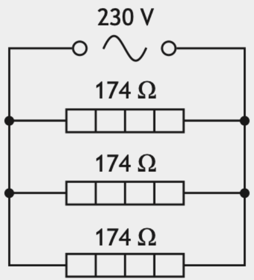
Also, calculate:

- the energy required to heat the clay brick (specific heat capacity = **810 J kg^{-1} °C^{-1}**)

  4·6 × 10^5 J

- total resistance of the heating elements

  58·0 Ω



- power developed in the circuit.

  910 W

Relationship sheet

Specific heat capacity and latent heat

2022 Q8bii

An electric iron operates at **230 V** a.c.

The power rating of the iron is **1750 W**.

When the iron is switched on, it takes **72·0 s** for the soleplate to reach the correct temperature.

During this time, **126 000 J** of energy is transferred to the soleplate.

Explain why the maximum temperature reached by the soleplate will be less than that calculated. **(1)**

Heat (energy) is lost to the surroundings/rest of iron/clothes (1)

Also, calculate:

- the current in the iron when operating normally

7·6 A

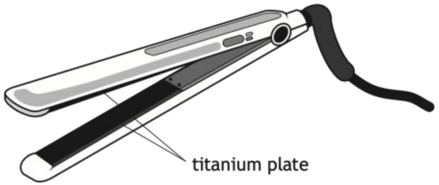
- the maximum temperature reached by the soleplate if it has a mass of **0·650 kg** and is initially at a temperature of **22 °C**

237 ºC

Specific heat capacity and latent heat

2023 Q8aii,8b

A set of hair straighteners contain a pair of titanium plates that are heated.



Explain why the energy supplied to the titanium plate is greater than the heat energy gained by the plate. **(1)**

<u>**Heat**</u> (energy) **lost** to the **surroundings**. **(1)**

The titanium plates are now replaced with ceramic plates. The titanium plate is at an initial temperature of **25 °C**.

The hair straighteners are switched on and the titanium plate reaches a temperature of **235 °C**.

Suggest **two** reasons why the time taken to heat the ceramic plates is different to the time taken to heat the titanium plates. **(2)**

different (specific) heat capacity **(1)**

different mass **(1)**

Also, calculate:

- the minimum energy to raise the titanium plates from **25°C** to **235°C** if…
    - the mass of the plates are **1.90×10^{-2} kg**.
    - the plates have a specific heat capacity of **532 J kg^{-1} $°C^{-1}$**.

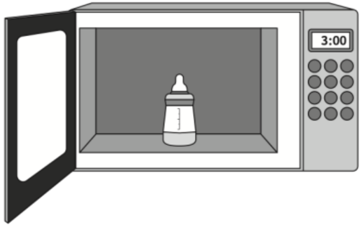
2120 J

Specific heat capacity and latent heat

2024 Q9bii

Bottles used for feeding babies require sterilising before use.

For one design of bottle, a microwave oven is used to heat water in the bottle. This produces steam, which sterilises the bottle.



Power rating:
750 W

Time to sterilise bottle: **180s**

Explain why the total energy used by the microwave oven during this time is different to the minimum energy required to produce the steam **(1)**

<u>Heat</u> loss to the **surroundings**. **(1)**

OR Not all the energy used by the microwave is transferred to the water.

Also, calculate:

- the energy required to bring **0.020 kg** of water to **boiling point** from **6.3 °C**

7 800 J

During heating, **0.014kg** of the water is change to steam

- calculate the energy required to change **0.014 kg** of water at boiling point to steam

32 000 J

- the minimum energy required to produce **0.014 kg** of steam from **0.020 kg** of water at **6.3°C**

39 800 J

- the total energy used by the microwave

140 000 J

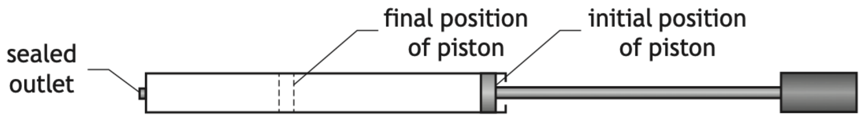
Gas laws and the kinetic model

2017 Q3b

A bicycle pump with a sealed outlet contains **$4{\cdot}0\times10^{-4}$ m^3** of air.

The air inside the pump is at an initial pressure of **$1{\cdot}0\times10^5$ Pa**.

The piston of the pump is now pushed slowly inwards until the volume of air in the pump is **$1{\cdot}6\times10^{-4}$ m^3** as shown.



Using the kinetic model, explain what happens to the pressure of the air inside the pump as its volume decreases. **(3)**

(individual) **particles** collide with **container/walls more frequently** (than before) **(1)**

(overall) **force** (on walls) is **greater (1)**

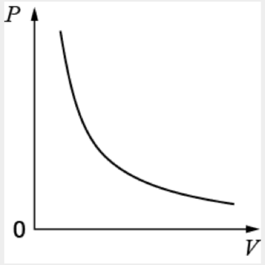
pressure increases (1)

Also, calculate:

- the final pressure of the air in the pump

$2{\cdot}5\times10^5$ Pa

- sketch a graph to show how the pressure of the air in the pump varies with volume as the piston is released and moves outward toward its original position



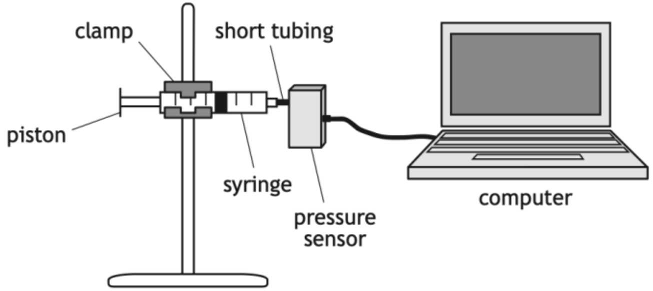
axes labelled p and V (1)

correct shape (curved) (1)

Gas laws and the kinetic model

SPQ Q8aii,8c

A student carries out an experiment to investigate the relationship between the pressure and volume of a fixed mass of gas using the apparatus shown.

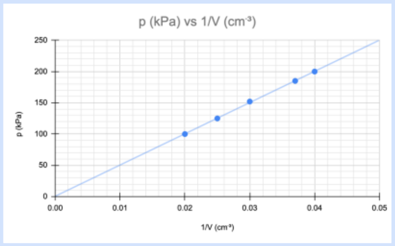


The pressure *p* of the gas is recorded using a pressure sensor connected to a computer. The volume *V* of the gas in the syringe is also recorded. The student pushes the piston to alter the volume and a series of readings is taken.

p (kPa)	100	125	152	185	200
V (cm^3)	50	40	33	27	25
$1/V$ (cm^{-3})	0·020	0·025	0·030	0·037	0·040

Draw:

- a graph of *p* against *1/V*.



Explain how the graph confirms that pressure is directly proportional to 1/volume. **(1)**

The line of **best fit** is a **straight line** which **passes** through the **origin (1)**

Using the kinetic model, explain the increase in the pressure of the gas in the syringe as its volume decreases. **(2)**

As **volume decreases**, the **particles** of gas will **strike** the piston of the syringe **more often (1)**

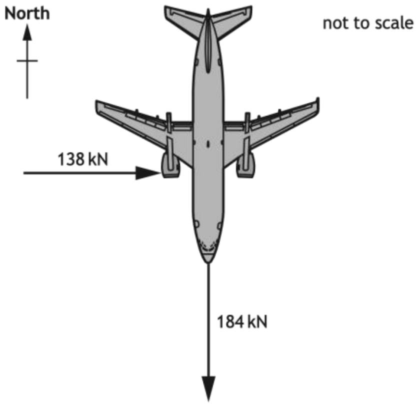
Since **P = F/A**, this results in an **increased pressure (1)**

Relationship sheet

Gas laws and the kinetic model

2018 1b

A passenger aircraft is flying horizontally.



During the flight the aircraft uses fuel.

Explain why the pressure exerted by the tyres of the aircraft on the runway after the flight is less than the pressure exerted by the tyres on the runway before the flight. **(2)**

Mass/**weight**/(downward) force is **less**. **(1)**

pressure is **force**/weight **per unit area**. **(1)**

Calculate:

- the magnitude and direction of the resultant force acting on the aircraft due to
  - engine (**184 kN due South**)
  - crosswind (**138 kN due East**)

230 kN at 143

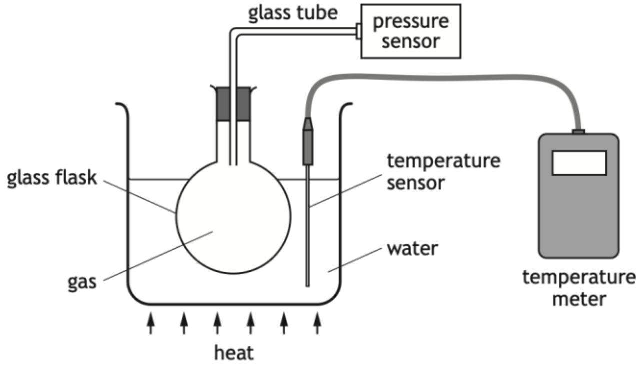
- The acceleration of the aircraft if its mass is **6.8×10^4 kg**.

$3{\cdot}4\ m\ s^{-2}$

Gas laws and the kinetic model

2018 9aii

A student sets up an experiment to investigate the relationship between the pressure and temperature of a fixed mass of gas as shown.



The student heats the water and records the following readings of pressure and temperature.

Pressure (kPa)	101	107	116	122
Temperature (K)	293	313	333	353

Using the kinetic model, explain why the pressure of the gas increases as its temperature increases. **(3)**

(The increase in temperature) **increases** the **kinetic energy** of the gas **particles**/the **particles** move **faster**. **(1)**

The **particles hit** the **container**/walls **more frequently**. **(1)**

The **particles hit** the **container**/walls with **greater force**. **(1)**

Predict:

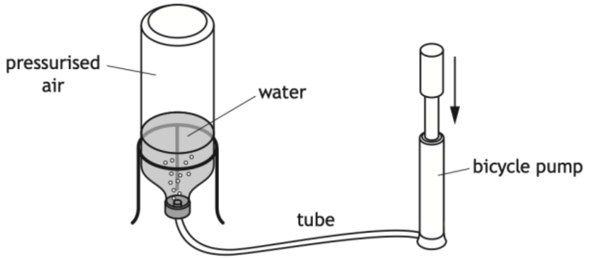
- the pressure reading which would be obtained if the student was to cool the gas to **253 K**

Any single value between 83 kPa and 89 kPa inclusive

Gas laws and the kinetic model

2019 8cii

A water rocket consists of a plastic bottle partly filled with water. Air is pumped in through the water. When the pressure is great enough, the tube detaches from the bottle. Water is forced out of the bottle, which causes the bottle to be launched upwards.



At launch, the air in the bottle is at a pressure of **$1{\cdot}74 \times 10^5$ Pa**.

Using the kinetic model, explain what happens to the pressure of the air inside the bottle as the volume of the air increases. **(3)**

(individual) **particles collide** with container/**walls less frequently** (than before) **(1)**

(overall) **force** (on walls) is **less (1)**

pressure decreases (1)

Calculate:

- the force exerted on the water at launch by the pressurised air if the area of contact is **4.50×10^{-3} m^2**

783N

- the pressure of the air in the bottle if the volume of the air in the bottle increases from **7.5×10^{-4} m^3** to **$1{\cdot}2 \times 10^{-4}$ m^3**.

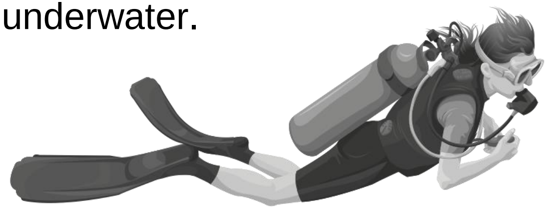
$1{\cdot}5 \times 10^5$ Pa

Relationship sheet

Gas laws and the kinetic model

2020 9bii

A scuba diver uses compressed air from a cylinder to breathe underwater.



Using the kinetic model, explain why the pressure of the gas inside the full cylinder decreases as the temperature decreases. **(3)**

(The decrease in temperature) **decreases** the **kinetic energy** of the gas **particles**/the **particles** move **slower**. (1)

The **particles hit** the **walls** of the **container less** often/**frequently**. (1)

The **particles hit** the walls of the container with **less force**. (1)

(since p= F/A and A is constant, the pressure decreases)

Calculate:

- the pressure in a full cylinder if…
    - the volume of a cylinder is **12 litres**
    - the compressed air is equivalent to **960 litres** of air at a pressure of **$2{\cdot}5 \times 10^5$ Pa**

$2{\cdot}0 \times 10^7$ Pa

A full cylinder of air at a pressure of **2.0×10^7 Pa** is stored at **21°C** before the dive.

Calculate:

- the temperature of the water that causes the pressure of the air in the cylinder to drop to **1.9×10^7 Pa** when submerged in the water.

280 K

Gas laws and the kinetic model

2022 9d

The tyre pressure in racing cars is carefully monitored throughout a race.

As the cars drive around the racing circuit, the temperature of the gas inside the tyres increases.

Explain, using the kinetic model, how this affects the pressure of the gas inside the tyres. **(3)**

(The increase in temperature) **increases** the **kinetic energy** of the gas **particles**/the **particles** move **faster**. **(1)**

The **particles hit** the tyre **walls** more **frequently**

OR

The **particles hit** the tyre **walls** with **greater force**. **(1)**

Pressure (in the tyre) **increases (1)**

Gas laws and the kinetic model

2023 9aiii

An aircraft is flying at high altitude.

During the flight the pressure of the air inside the aircraft is reduced.

State what is meant by the term pressure. **(1)**

Force per **unit area (1)**

Describe how the kinetic model accounts for the pressure of the gas inside the crisp packet. **(1)**

The (gas) **particles collide** with the **walls** (of the crisp packet). **(1)**

During the flight a passenger notices that the volume of a crisp packet is greater than it was at take-off.

At take-off the pressure of the gas inside the crisp packet was **101 kPa** and the volume of gas in the crisp packet was $\mathbf{2.3 \times 10^{-3}\ m^3}$.

During the flight the pressure of the gas inside the crisp packet is **92 kPa**.

The temperature of the gas inside the crisp packet remains constant.

Calculate:

- the volume of the gas inside the crisp packet at a pressure of **92 kPa**.

$\mathbf{2.5 \times 10^{-3}\ m^3}$

← *Properties of matter (explanation questions)*

Relationship sheet

Gas laws and the kinetic model

2024 10aii

A cyclist inflates the tyres on their bike before going cycling.

The cyclist inflates a tyre to a pressure of **655 kPa**.

The temperature of the gas inside the tyre is **21 °C**.

At one point in the journey the temperature of the gas inside the tyre is **14 °C**. The mass of gas and the volume of gas inside the tyre remain constant.

Explain, using the kinetic model, how the decrease in temperature affects the pressure of the gas inside the tyre. **(3)**

(As the temperature decreases) the **kinetic energy** of the particles **decreases**/particles move slower **(1)**

Particles collide with the walls of the container **less frequently**/often **OR Particles collide** with the walls of the container **with less force (1)**

Pressure decreases (1)

Calculations:

- the pressure when the temperature of the gas is 14°C. **639 kPa**
- the mass of cyclist and bike if pressure on ground is **1.02x10^{6} Pa** and area of contact is **7.5x10^{-4} m^{2}**. **78 kg**

N5 Physics Revision

Past paper selector

Questions on required **experiments** (descriptions and improvements)

Questions that require **explanations**

Suggestions for **Open Ended Questions**

Questions that require **drawing graphs**

Questions on **unfamiliar Physics**

Questions that require **drawing sketches**

← Back to **Waves (explanation)** questions

Relationships sheet

Dynamics

$d = vt$

$F = ma$

$d = \bar{v}t$

$W = mg$

$s = vt$

$E_w = Fd$

$s = \bar{v}t$

$E_p = mgh$

$a = \frac{v-u}{t}$

$E_k = \frac{1}{2}mv^2$

Electricity

$Q = It$

$P = \frac{E}{t}$

$V = IR$

$V_2 = \left(\frac{R_2}{R_1 + R_2}\right)V_S$

$P = IV$

$P = I^2R$

$\frac{V_1}{V_2} = \frac{R_1}{R_2}$

$P = \frac{V^2}{R}$

$R_T = R_1 + R_2 + ...$

$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + ...$

Properties of matter

$E_h = cm\Delta T$

$p_1V_1 = p_2V_2$

$E_h = ml$

$\frac{p_1}{T_1} = \frac{p_2}{T_2}$

$p = \frac{F}{A}$

$\frac{V_1}{T_1} = \frac{V_2}{T_2}$

$\frac{pV}{T} = \text{constant}$

Radioactivity

$A = \frac{N}{t}$

$H = Dw_r$

$D = \frac{E}{m}$

$\dot{H} = \frac{H}{t}$

Waves

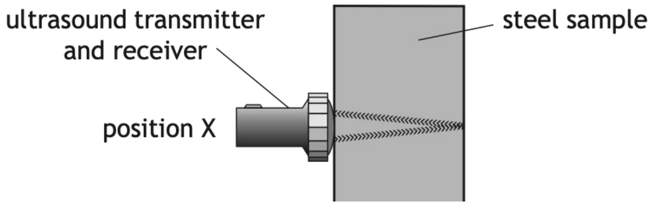
$f = \frac{N}{t}$

$v = f\lambda$

$T = \frac{1}{f}$

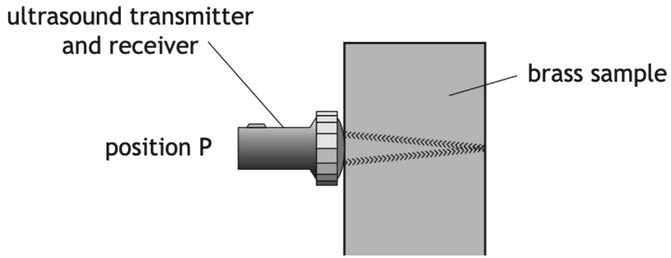
Wave parameters & behaviours

2015 3d



The time between the ultrasound pulse being transmitted and received at position P is greater than the time recorded at position X in the steel sample.

(The **brass** sample has the **same thickness** as the **steel** sample)



State whether the speed of ultrasound in brass is less than, equal to or greater than the speed of ultrasound in steel.

You must justify your answer. **(2)**

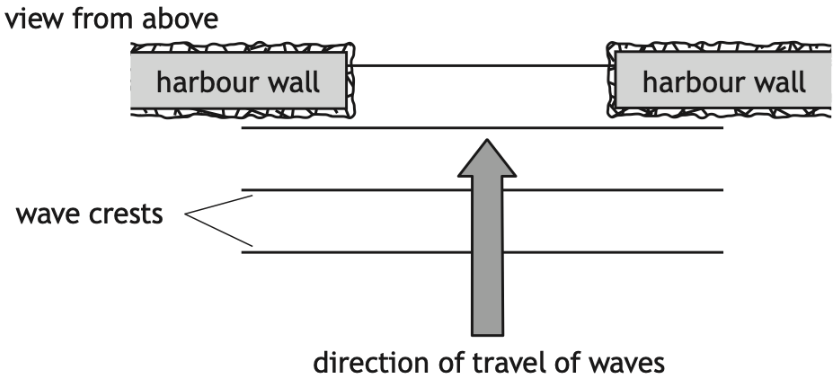
Speed of ultrasound in **brass** is **less** than in steel. **(1)**

Takes **greater time** to **travel** (same) distance /thickness. **(1)**

Calculations:
Lots of challenging problem solving questions here, worth the time!

Diffraction

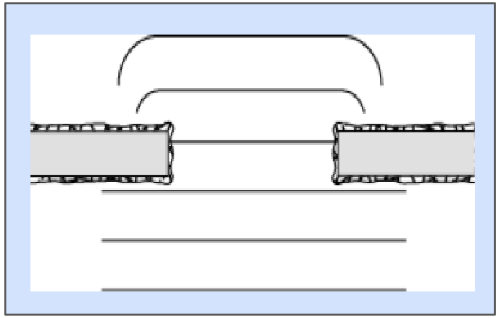
2017 4d



As the waves pass into the harbour the student observes that the amplitude of the waves decreases.

Explain this observation. **(1)**

energy decreases/lost



Calculations:

- the frequency if the time for one wave to pass a point of **2.5 s**

0.40 Hz

- the velocity if the wavelength of the waves is **8.0 m**

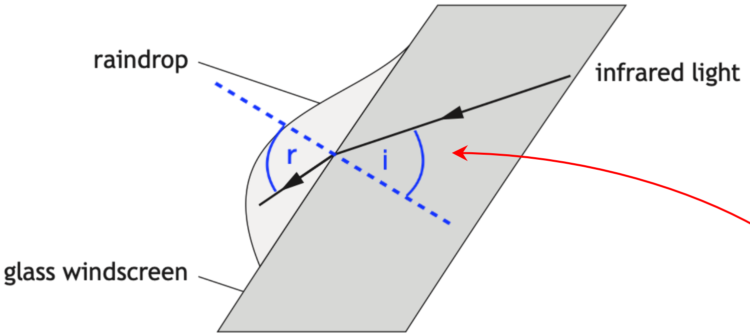
3.2 ms^{-1}

Diagram:
draw wave crests inside the harbour

Refraction

2018 11cii

Some of the infrared light is refracted when travelling from the glass windscreen into a raindrop.



State whether the wavelength of the infrared light in the raindrop is less than, equal to or greater than the wavelength of the infrared light in the glass.

You **must** justify your answer. **(2)**

Wavelength in water is **greater** than in glass **(1)**

Speed of light in water is **greater** than in glass. **(1)**

Other questions:
Suitable detector of infrared

Any one of: photodiode phototransistor, thermistor, LDR, thermocouple, thermopile, CCD.

Diagram:
Draw normal, angle i and r

Wave parameters & behaviours

2019 9b

When the pager receives a message it beeps loudly and a light on the pager flashes.

A crew member holding the pager observes the beeps and the flashes happening at the same time.

A second crew member, who is 100 m away from the pager, also observes the beeps and the flashes.

Explain why the second crew member does not observe the beeps and the flashes happening at the same time. **(2)**

The **speed of light** is (much) **greater** than the speed of sound. **(1)**

The **sound** takes **more time** to travel (the 100 m). **(1)**

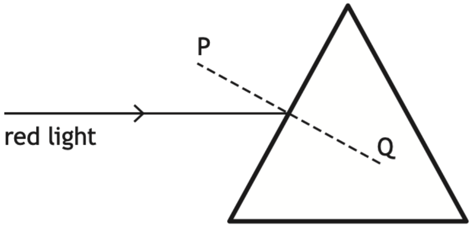
Calculation:
Find the wavelength of radio waves if the frequency is 153 MHz.

2.0 m

Refraction

2019 11b

The student replaces the triangular glass block with a rectangular block made of the same material. The path of the ray of red light is as shown.



State whether the wavelength of the red light in this **block** is less than, the same as, or greater than the wavelength of the red light in the **triangular glass block**.

Justify your answer. **(2)**

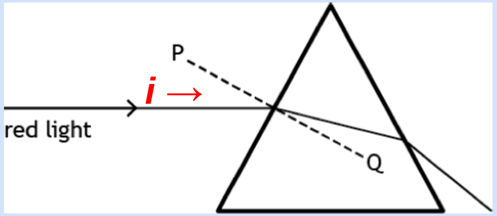
(wavelength is the) **same (1)**

the blocks are made of the **same material**. **(1)**

Diagram:
Draw the red light through and out of the prism.

Name the dashed line. **normal**

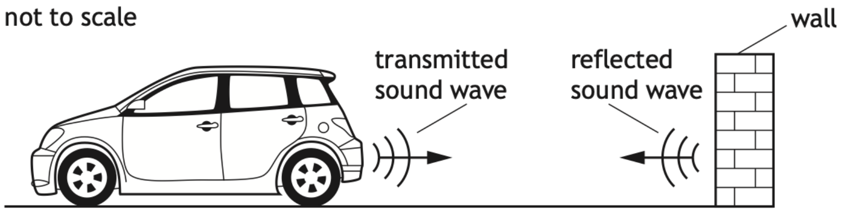
Identify the angle of incidence *i*



Wave parameters and behaviours

2023 10bii

During testing, a stationary car emits a sound wave with a frequency of **48 000 Hz**. The time taken between the sound wave being emitted and detected by the car is **0.015 s**.



The system in the car is now adjusted to emit sound waves with a different frequency.

Explain why the time taken between this sound wave being emitted and detected is also **0.015 s. (1)**

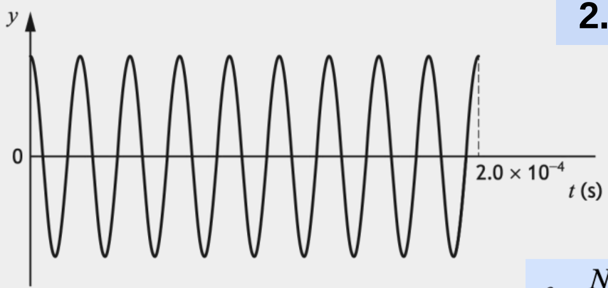
Speed (of sound in air) is the **same**

OR The **distance** is the **same**

Calculations:

Determine distance between the car and the wall.

2.6 m



Show that the frequency of the new sound wave (wave displayed above) is **45 000 Hz**

$f = \frac{N}{t}$

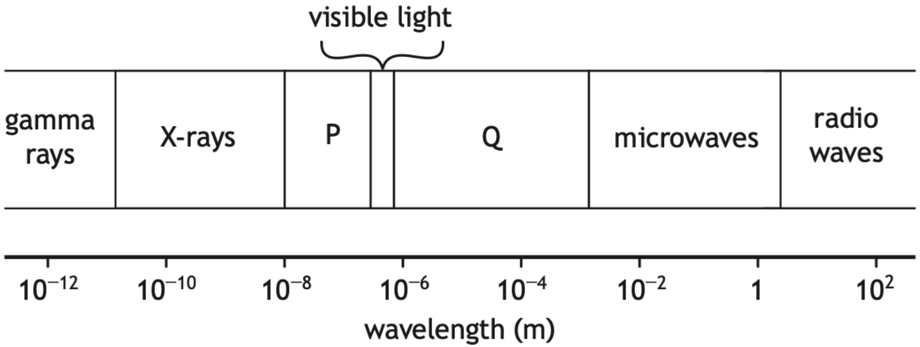
$f = \frac{9}{2.0 \times 10^{-4}}$

$f = 45\,000$ Hz

Diffraction

2023 11b

The diagram shows the electromagnetic spectrum in order of increasing wavelength.



State which part of the electromagnetic spectrum experiences the greatest amount of diffraction.

Justify your answer. **(2)**

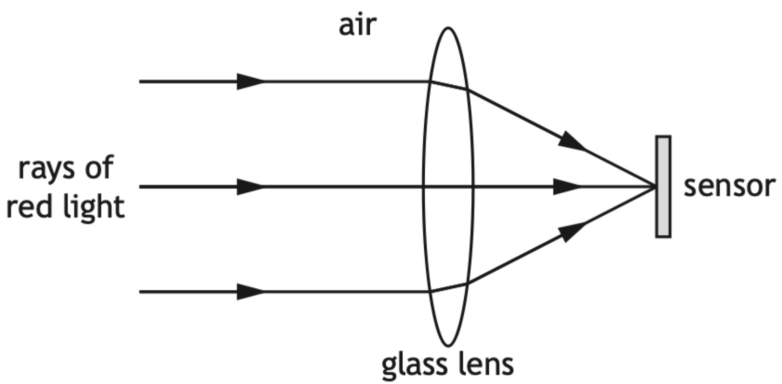
Radio (waves) **(1)**

Have the **longest** wavelength **(1)**

Refraction

2024 12bi

The camera in the mobile phone uses a glass lens to focus rays of the red light onto a sensor as shown.



Explain why the ray of red light passing through the centre of the lens does not change direction. **(1)**

Ray of light is incident at 90°/right angles/perpendicular to the lens

OR

Ray of light is travelling along the normal

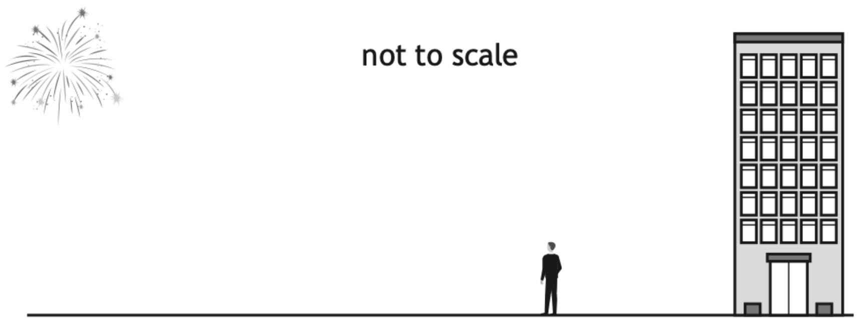
Other question:
How does the frequency of the red light inside the lens compare with the frequency in the air?

equal to *(**frequency does not change**, only **speed** and **wavelength** change)*

Wave parameters and behaviours

2024 12c

At one point during the display the student moves to a position near a tall building and, as a result, now hears two bangs from each firework explosion.



State how the amplitude of the second bang from each explosion heard by the student compares to the amplitude of the first bang from each explosion heard by the student.

You must justify your answer. **(2)**

(The **amplitude** of the second bang is) **less** than (the amplitude of the first bang.) **(1)**

(The reflected sound has travelled further so) the **second bang** has **less energy** than the first bang **(1)**

N5 Physics Revision

Past paper selector

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Suggestions for **Open Ended Questions**

Questions that require **drawing graphs**

Questions on **unfamiliar Physics**

Questions that require **drawing sketches**

← Back to **Space (explanation)** questions

Relationships sheet

Dynamics

$d = vt$

$F = ma$

$d = \bar{v}t$

$W = mg$

$s = vt$

$E_w = Fd$

$s = \bar{v}t$

$E_p = mgh$

$a = \frac{v-u}{t}$

$E_k = \frac{1}{2}mv^2$

Electricity

$Q = It$

$P = \frac{E}{t}$

$V = IR$

$V_2 = \left(\frac{R_2}{R_1 + R_2}\right)V_S$

$P = IV$

$P = I^2R$

$\frac{V_1}{V_2} = \frac{R_1}{R_2}$

$P = \frac{V^2}{R}$

$R_T = R_1 + R_2 + ...$

$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + ...$

Properties of matter

$E_h = cm\Delta T$

$p_1V_1 = p_2V_2$

$E_h = ml$

$\frac{p_1}{T_1} = \frac{p_2}{T_2}$

$p = \frac{F}{A}$

$\frac{V_1}{T_1} = \frac{V_2}{T_2}$

$\frac{pV}{T} = \text{constant}$

Radioactivity

$A = \frac{N}{t}$

$H = Dw_r$

$D = \frac{E}{m}$

$\dot{H} = \frac{H}{t}$

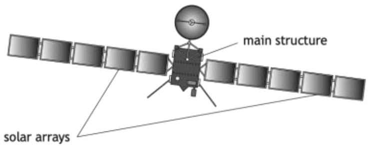
Waves

$f = \frac{N}{t}$

$v = f\lambda$

$T = \frac{1}{f}$

Space and Cosmology



2016 Q12b

On 12th November 2014, on a mission known as Rosetta, the European Space Agency successfully landed a probe on the surface of a comet.

Rosetta spacecraft data		
Launch mass	Orbiter Lander Propellant	$1{\cdot}23 \times 10^3$ kg $0{\cdot}10 \times 10^3$ kg $1{\cdot}67 \times 10^3$ kg
	Total	$3{\cdot}00 \times 10^3$ kg
Energy source	Solar array output	850 W at 3·4 AU 395 W at 5·25 AU
Trajectory control	24 Thrusters	10 N of force each

The solar arrays contain photovoltaic cells.

i) State the energy change in a photovoltaic cell. **(1)**

ii) Suggest why the solar arrays were designed so that they can rotate. **(1)**

i) **light** (energy) to **electrical** (energy) **(1)**

ii) **Maximise** the **light received** (from the Sun) **(1)**

Accept: So that they always face the Sun (or similar)

Calculations:

The weight of the spacecraft on Earth

2.9×10^4 N

Total energy output of solar arrays when operating at **5.25 AU** for **2 hours**

2.8×10^6 J

Total force produced by **four** thrusters

40 N

Acceleration due to thrusters if **1.00×10^3 kg** of propellant was used in this time

0.02 ms^{-2}

← *Space (explanation questions)*

Relationship sheet

Space and Cosmology

2016 Q13d

Read the passage and answer the question.

Supernova explosion

The average temperature of the surface of the Sun is 5778 K. In the core of the Sun energy is produced by nuclear fusion.

Once the Sun has used all its nuclear fuel it will collapse to form a white dwarf. A star with a mass much larger than that of the Sun will end its life in an enormous explosion called a supernova. The energy released in a supernova explosion is more than a hundred times the energy that the Sun will radiate over its entire 10 billion year lifetime.

In our galaxy, the star Betelgeuse is predicted to explode in a supernova. Betelgeuse has a mass of around 8 times the mass of the Sun. Even though Betelgeuse is 640 light-years from Earth, the supernova will be as bright as a full moon at night in our sky.

Betelgeuse may have already exploded in a supernova. Explain this statement. **(1)**

The **light**/radiation from the **explosion** has **not reached** the **Earth** yet. **(1)**

OR

The **light**/radiation takes **time**/**640 years** to **reach Earth** /to get here.

Calculations:

Determine the average temperature of the surface of the Sun in degrees Celsius

5505 °C

Calculate the distance from the Earth to Betelgeuse in metres

6.1 x 10^{18} m

Space and Cosmology

SPQ Q2b,c

The Soyuz Spacecraft is used to transport astronauts from the International Space Station (ISS) to Earth.

During the flight, the Orbital Module and the Instrumentation/Propulsion Module are jettisoned. Instead of returning to Earth, they burn up in the atmosphere at a very high temperature.

b) Explain why these Modules burn up on re-entry into the atmosphere. ***(2)***

After the Descent Module has re-entered the atmosphere, its speed is dramatically reduced. Four parachutes are used to slow the Module's rate of descent.

c) Explain, in terms of forces, how the parachutes reduce the speed of the Module. ***(2)***

b) **Force** of **friction** is created on the **surface** of the modules **(1)**

causes **heat** to be produced **(1)**

c) **Upward force** is **increased** (by parachutes) **(1)**

producing an **unbalanced force upwards (1)**

Calculations:

the acceleration of spacecraft as it leaves ISS if it's mass is **7150 kg** and the propulsion force is **1430 N**.

0.2 ms^{-2}

The force produced by engines just before touchdown to Earth if the work done by the engines is **8.0 x 10^4 J** over a distance of **5.0 m.**

16 000 N

Space and Cosmology

SPQ Q2d

The ISS orbits with an altitude of between
$3{\cdot}30 \times 10^5$ m and **$4{\cdot}35 \times 10^5$ m** above the surface of the Earth.

i. State whether the orbital period of the ISS in its highest orbit will be less than, the same as, or greater than the orbital period in its lowest orbit? **(1)**

i. Explain, in terms of its horizontal velocity and weight, how the ISS remains in orbit around the Earth. **(2)**

i) (Orbital period will be) **greater (1)**

ii) The **horizontal velocity** of the ISS is **large** enough to ensure that it **does not get closer** to the Earth's surface (or equivalent statement) **(1)**

The **weight** of the ISS is **large** enough to ensure that it does **not move further away** from the Earth's surface (or equivalent statement) **(1)**

Space and Cosmology

2018 Q4b

Within our solar system distances are often measured in astronomical units (AU).

$$1 \text{ AU} = 1{\cdot}50 \times 10^{11} \text{ m}$$

Mars orbits the Sun at an average distance of 1·52 AU.

In the future it is hoped that humans will be able to travel to Mars. One challenge of space travel to Mars is maintaining sufficient energy to operate life support systems.

i. Suggest one solution to this challenge. **(1)**

i. State another challenge of space travel to Mars. **(1)**

i) **Solar cells (1)**

ii) **One** of the following:

Manoeuvring in zero friction environment
Fuel load on take-off
Potential exposure to radiation
Pressure differential
Re-entry through an atmosphere

Calculations:

average distance in metres at which Mars orbits the Sun

2.28×10^{11} (m)

average time for light from the Sun to reach Mars

760 s

Relationship sheet

Space and Cosmology

2019 Q4b,c

Astronomers studying a distant star analyse the light from the star that reaches Earth. A star is **97 light-years** from Earth.

Astronomers use satellite-based telescopes to collect information about objects in space.

bi) State what is meant by the term *light-year*. **(1)**

ci) Suggest an advantage of using satellite-based telescopes such as the Hubble Space Telescope. **(1)**

cii) State one **other** use of satellites. **(1)**

bi) The **distance** light travels in one year.

ci) **One** of the following:

- No atmosphere to absorb light
- full range of EM waves can be observed
- can be used in cloudy weather/ daytime
- no light pollution

cii) GPS, weather forecasting, communications, scientific discovery

Calculations:
the distance, in metres, from the star to Earth

9.2×10^{17} (m)

Space and Cosmology

2020 4b,c,dii

The table shows information about the moons of the dwarf planet Pluto.

Name	Mass (kg)	Orbital period (days)	Approximate diameter (km)
Charon	$1{\cdot}6 \times 10^{21}$	6·39	1200
Nix	$5{\cdot}0 \times 10^{16}$	24·9	50
Hydra	$5{\cdot}0 \times 10^{16}$	38·2	51
Kerberos	$1{\cdot}6 \times 10^{16}$	32·2	19
Styx	$7{\cdot}5 \times 10^{15}$	20·2	16

State which of these moons orbits at the greatest distance from Pluto.

Justify your answer. **(2)**

Hydra (1)
Longest orbital period **(1)**

On its journey to Pluto, the space probe New Horizons passed close by the planet Jupiter.

Explain how passing close to Jupiter reduced the journey time to Pluto. **(2)**

It received a gravitational boost/ **slingshot**/catapult from **Jupiter (1)**
(causing) an **increase** in its **speed**/kinetic energy **(1)**

New Horizons maintained this speed as it travelled on towards Pluto.

Explain, in terms of forces, why New Horizons did not have to use any fuel in order to maintain this speed. **(2)**

There is **no friction**/air resistance/ opposing force **(1)**
Therefore there is **no unbalanced force (1)**

← *Space (explanation questions)*

Relationship sheet

Space and Cosmology

2022 Q3b

A spaceship on Mars is being prepared for the return journey to Earth.

The mass of the spaceship including fuel and crew is **1.3×10^6 kg**.

The rocket engines on the spaceship produce a constant upward thrust of **1.2×10^7 N**.

State what happens to the acceleration of the spaceship as its altitude increases.

Justify your answer. **(2)**

Acceleration **increases (1)**

Weight/mass **decreases** (as fuel is used)

OR

Gravitational field strength decreases **(1)**

Calculations:

The weight of the spaceship on Mars

4.8×10^6 N

The acceleration of the spaceship at launch off the surface of Mars

5.5 ms^{-2}

Space and Cosmology

2022 Q5b

Read the passage and answer the questions that follow.

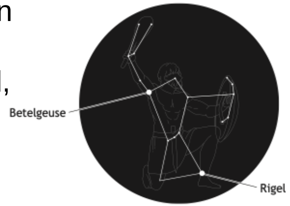
Making plans for Rigel

Betelgeuse might be regularly mentioned in the news but there are other supergiants in the night sky. One of these is Rigel, a blue supergiant star that makes up the ‘left foot’ of the constellation of Orion. It is approximately 8 million years old and is one of the brightest stars in our night sky.

Blue supergiants, such as Rigel, are short-lived and are destined to explode as a supernova. Even though Rigel is 860 light-years from Earth, the supernova will be clear to see. Astronomers believe that it will be as bright as a half-moon and will be visible in the sky during the day. However, the light show will only last a few months before it fades.

When it explodes, Rigel will throw debris into space at approximately 5% of the speed of light. Intense waves of radiation, including X-rays and gamma rays, will be radiated into space. The core of the star will collapse into an extremely dense ball of nuclear matter called a neutron star.

It is not possible to predict exactly when Rigel will explode and there is the possibility that it has already happened, it just hasn’t been detected yet! The best estimate scientists have is that it will take place within the next million years, or so.



Orion

Explain why the supernova explosion may already have happened but has not yet been detected. **(1)**

Light/EM radiation will take **860 years** to **reach Earth**.

OR

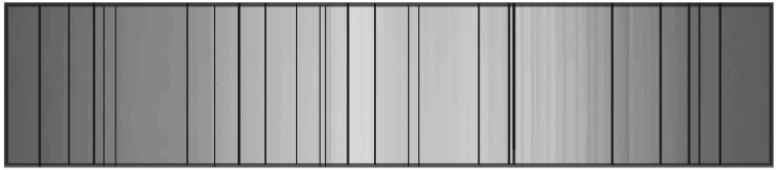
The **light**/EM radiation from the **supernova** has **not reached Earth yet**.

Space and Cosmology

2022 Q5c

Astronomers can identify elements present in stars by studying the spectrum of the light they produce.

A spectrum from a star is shown.



(i) State the type of spectrum shown. **(1)**

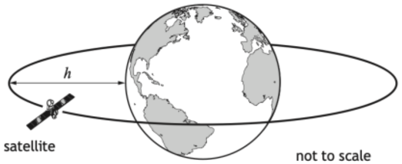
(ii) Explain how the spectrum can be used to identify the elements present in the star. **(1)**

(i) **line** (spectrum) (**Accept** absorption spectrum)

(ii) (Lines in) this **spectrum** can be **matched**/compared with (lines in) the **spectrum** from the **element**.

Relationship sheet

Space and Cosmology



2023 Q3a

Television signals are transmitted from satellites that remain above the same point on Earth's surface at all times.

Information about some satellites are shown in the table.

Name of satellite	Date launched	Orbital altitude h (km)	Orbital period T
UKube-1	8 July 2014	825	101 minutes
Kosmos 2460	1 March 2010	19 100	676 minutes
Magellan	22 August 2019	20 200	718 minutes
Astra 1KR	20 April 2006	36 000	24 hours
Vela 4B	28 April 1967	111 000	111 hours

State which of the satellites in the table is used to transmit these television signals.

You must justify your answer. **(2)**

Astra 1KR (1)

it is a **geostationary satellite**
OR
it has an **orbital period** of **24 hours**
OR
it is at an **orbital altitude** of **36 000 km (1)**

Calculation:
The weight of *UKube-1* at an orbital altitude of **825 km** where the gravitational field strength is **7.7 Nkg^{-1}**

27 N

Predict:
The orbital period of another satellite orbiting at an altitude of **1200 km.**

any single value greater than **101 minutes** and less than **676 minutes**

Space and Cosmology

2024 Q4b

NASA is planning a crewed mission to the Moon.

Part of the mission includes placing a spacecraft in orbit at an altitude of 140 km above the surface of the Moon.

Once the spacecraft is in orbit, some of the astronauts will travel to the surface of the Moon in a transportation module.

These astronauts will remain on the surface of the Moon for approximately one week.

Describe one physics-related challenge these astronauts will face while on the surface of the Moon. **(1)**

exposure to radiation

OR pressure differential

OR lower gravitational field strength

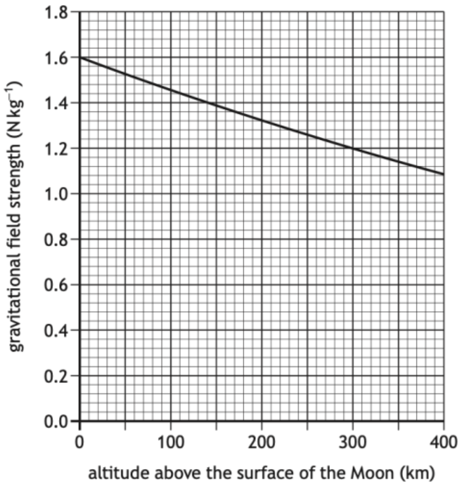
OR extreme temperatures

Space and Cosmology

2024 Q4c

The graph shows the gravitational field strength at different altitudes above the surface of the Moon.

After spending time on the Moon, the astronauts will return to the orbiting spacecraft using the transportation module.



During the first part of this return journey, the rockets on the transportation module will exert a constant upward force.

State what will happen to the acceleration of the transportation module during this part of the journey.

You must justify your answer.

Acceleration **increases** (1)

Justification:

mass decreases (as fuel is used)
OR **gravitational field strength** decreases (with altitude) (1)

weight decreases OR **unbalanced force** increases (1)

Calculation:
Calculate the weight of an astronaut with a mass of **67 kg** when they are at an altitude of **140 km** above the surface of the Moon.

94 N

Space and Cosmology

2024 Q15a

Read the passage and answer the question that follows.

Spacecraft travelling to distant parts of the Solar System need to have a source of power to operate their electrical systems.

Many spacecraft use solar cells to generate electricity, but this is not always suitable.

Some spacecraft, such as Voyager 2, are powered using energy generated by Radioisotope Thermoelectric Generators (RTGs). The RTGs in Voyager 2 use plutonium-238 as a fuel. The half-life of plutonium-238 is 88 years. The plutonium decays to uranium in a nuclear fission reaction. The heat generated by this radioactive decay is then converted into electrical energy.

In the future, NASA plans to equip spacecraft with miniature nuclear reactors, which use nuclear fission chain reactions to generate power.

Explain why solar cells may not be a suitable source of power when exploring distant parts of the Solar System. **(1)**

less energy/power from the Sun (is available at greater distance from the Sun)

OR

less light from the Sun (is available at greater distance from the Sun)

OR

would **need** a (very) **large area** of **cells** (to generate the same amount of power)

N5 Physics Revision

Past paper selector

Questions on required **experiments** (descriptions and improvements)

Questions that require **explanations**

Suggestions for **Open Ended Questions**

Questions that require **drawing graphs**

Questions on **unfamiliar Physics**

Questions that require **drawing sketches**

Gas laws graphing

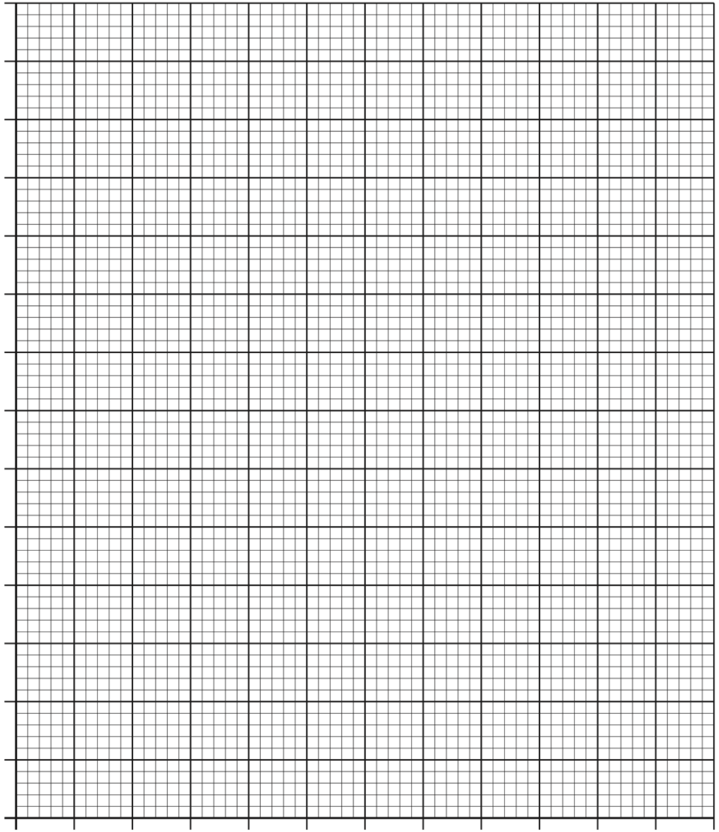
SQP Q8a

The results are shown.

p (kPa)	100	125	152	185	200
V (cm^3)	50	40	33	27	25
$1/V$ (cm^{-3})	0·020	0·025	0·030	0·037	0·040

i) Draw a graph of p against 1/V **(3)**

ii) Explain how the graph confirms that pressure is directly proportional to 1/volume. **(1)**



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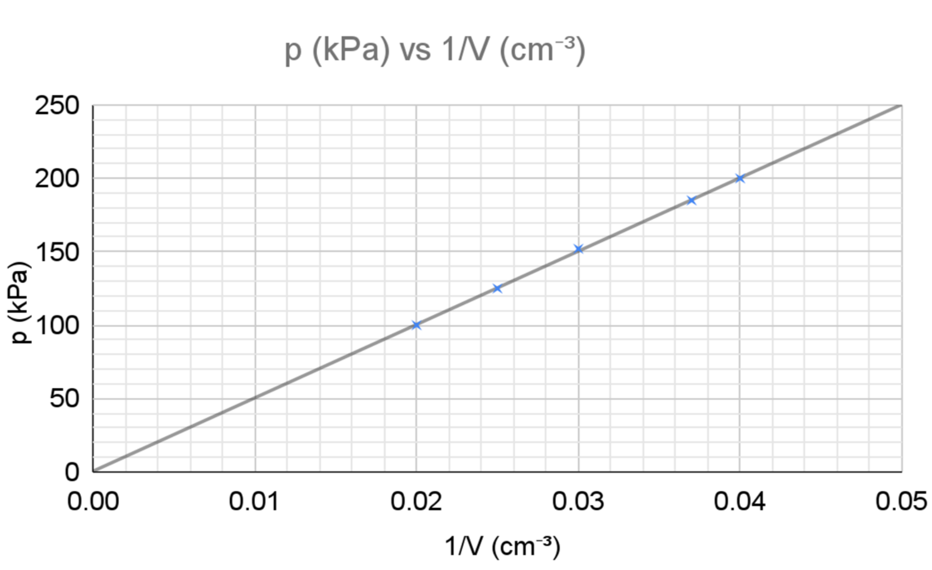
i) Axes **labelled** with **units (1)**

Axes **scaled linearly (1)**

Data points **accurately plotted** with **line** of **best fit (1)**

ii) The **line** of **best fit** is a **straight line** which **passes through** the **origin (1)**



Half life graphing

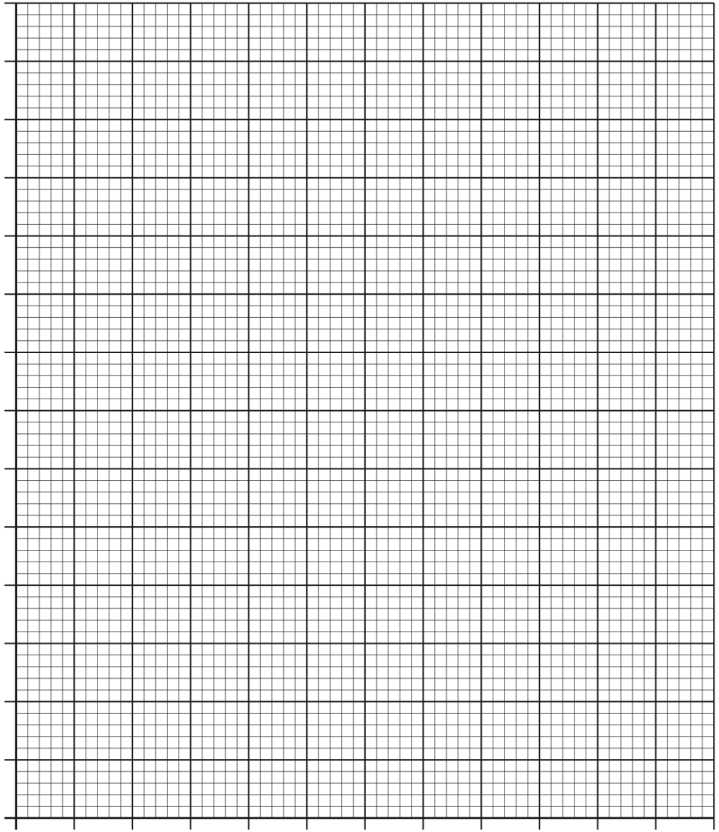
2018 Q13b

The technician's results are shown in the table.

Time (minutes)	*Corrected count rate* (counts per minute)
0	680
20	428
40	270
60	170
80	107
100	68

Using the graph paper, draw a graph of these results.

Use your graph to determine the half-life of the gamma radiation source.



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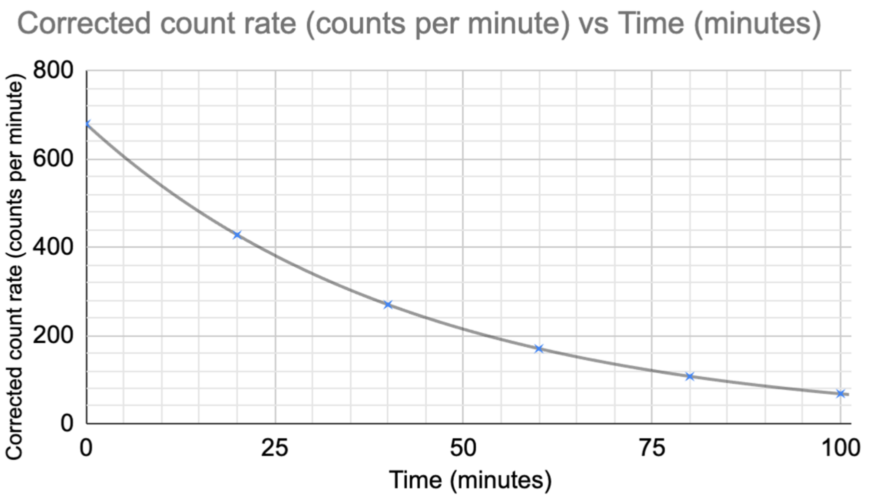

Using the graph paper, draw a graph of these results.

Use your graph to determine the half-life of the gamma radiation source.

Suitable **scales**, **labels** and **units (1)**

All points **plotted accurately** to ±half a division **(1)**

Best fit curve (1)

Half-life is **30 minutes**

Conservation of energy graphing

2015 Q11b

The student drops the marble from different heights and measures the diameter of each crater that is formed. The table shows the student’s results.

(i) Using the graph paper, draw a graph of these results.

height (m)	*diameter* (m)
0·05	0·030
0·10	0·044
0·15	0·053
0·35	0·074
0·40	0·076
0·45	0·076

(ii) Use your graph to predict the diameter of the crater that is formed when the marble is dropped from a height of **0·25 m**.

Conservation of energy graphing

2015 Q11b

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(i) Using the graph paper, draw a graph of these results.

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0·40	0·076
0·45	0·076

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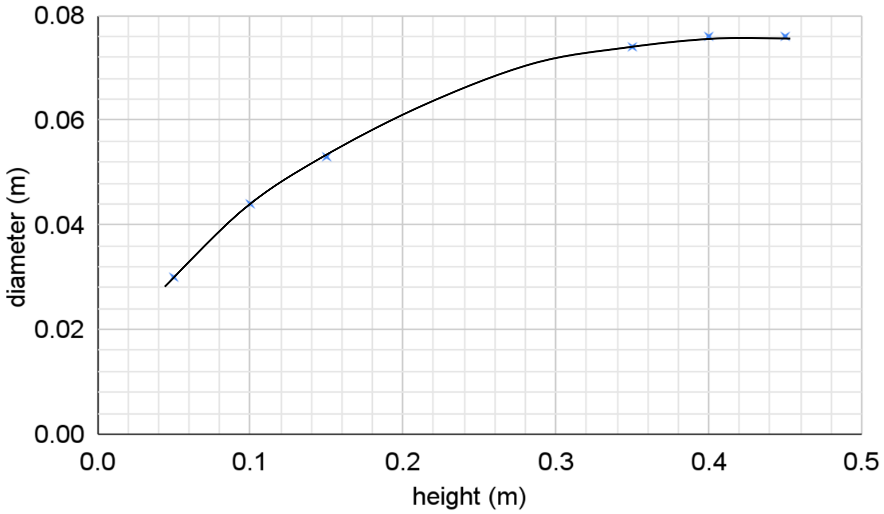


(i) suitable scales, labels and units **(1)**

all points plotted accurately to ± half a division **(1)**

best fit **<u>curve</u>** **(1)**

(ii) Consistent with best fit curve from (b)(i).

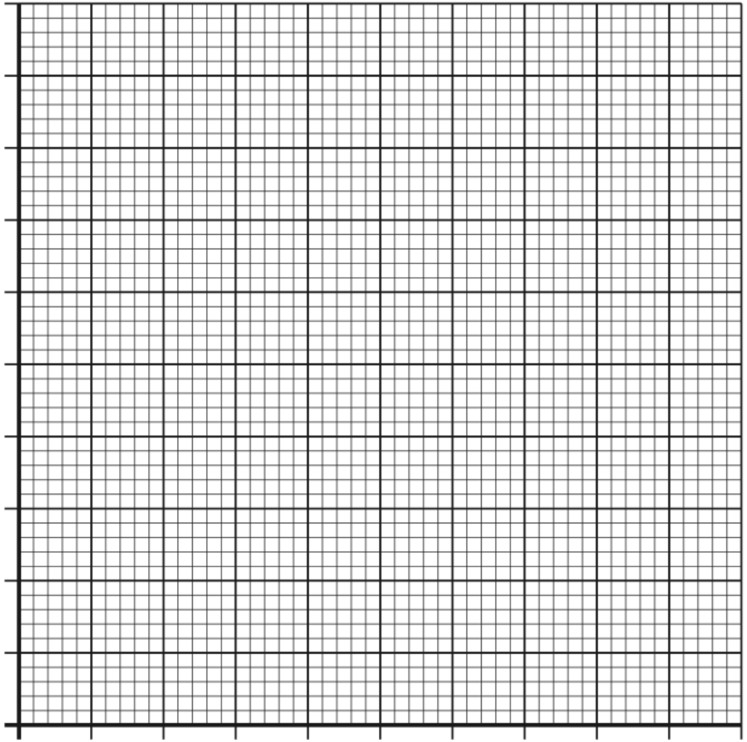
Electricity graphing

2019 Q5a

A student is investigating how the length of a wire affects its resistance.
The student connects different lengths of wire to a power supply of fixed voltage and measures the current in each length of wire.

Length of wire (m)	Current (A)
0·20	0·94
0·40	0·66
0·60	0·47
0·80	0·37
1·00	0·32

i) Using the graph paper, draw a graph of these measurements. **(3)**
ii) State whether the resistance of the wire increases, decreases or stays the same, as the length of wire increases. **Justify your answer. (2)**
iii) Use your graph to predict the current in a **0·50 m** length of wire, when connected to the power supply. **(1)**



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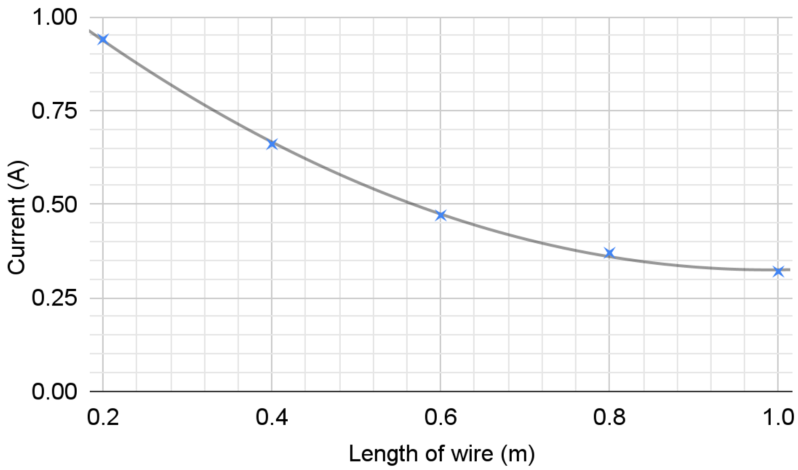

(i) suitable **scales**, **labels** and **units (1)**
all points **plotted accurately** to ± half a division **(1)**
best fit curve **(1)**

(ii)(Resistance of wire) **increases** (as the length of wire increases) **(1)**

Current decreases (as the length of wire increases). **(1)**

(iii) **0·55 A (1)**

Waves graphing

2020 Q11c

The student carries out an experiment to investigate how the length of the straw affects the frequency of the sound produced. The results of this experiment are as shown.

Length of straw (mm)	Frequency (Hz)
20	1204
40	597
60	420
80	282
100	250

i) Using the graph paper below, draw a graph of these results.

i) Use your graph to predict the frequency of sound produced by a straw that is **30 mm** in length.

Waves graphing

2020 Q11c

The student carries out an experiment to investigate how the length of the straw affects the frequency of the sound produced. The results of this experiment are as shown.

Length of straw (mm)	Frequency (Hz)
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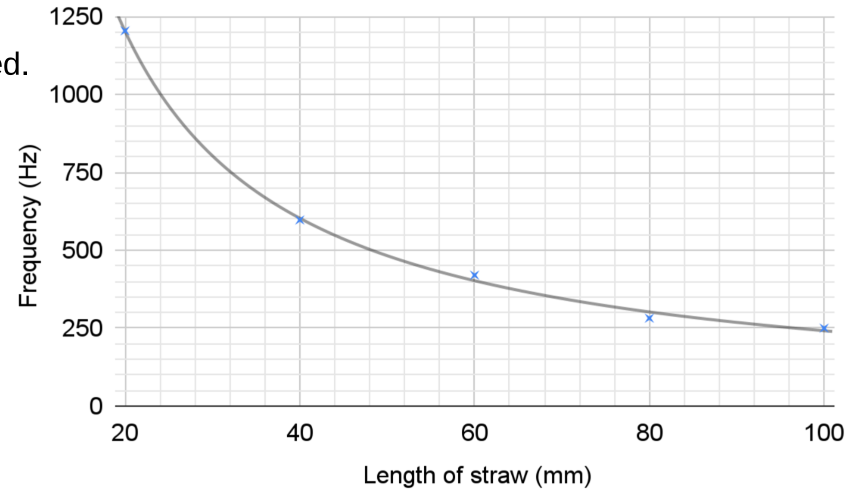


i) Using the graph paper below, draw a graph of these results.

i) Use your graph to predict the frequency of sound produced by a straw that is **30 mm** in length.

i) Suitable **scales**, **labels** and **units (1)**

All points **plotted accurately** to ± half a division **(1)**

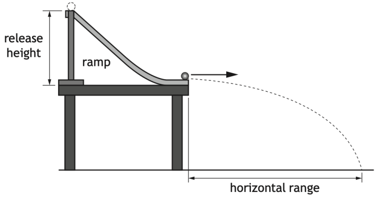
Best fit curve (1)

ii) (Resistance of wire) **increases** (as the length of wire increases) **(1)**
Current decreases (as the length of wire increases). **(1)**

Projectile motion graphing

2022 Q2a

A student is investigating factors that affect the horizontal range of a marble, using the apparatus shown.

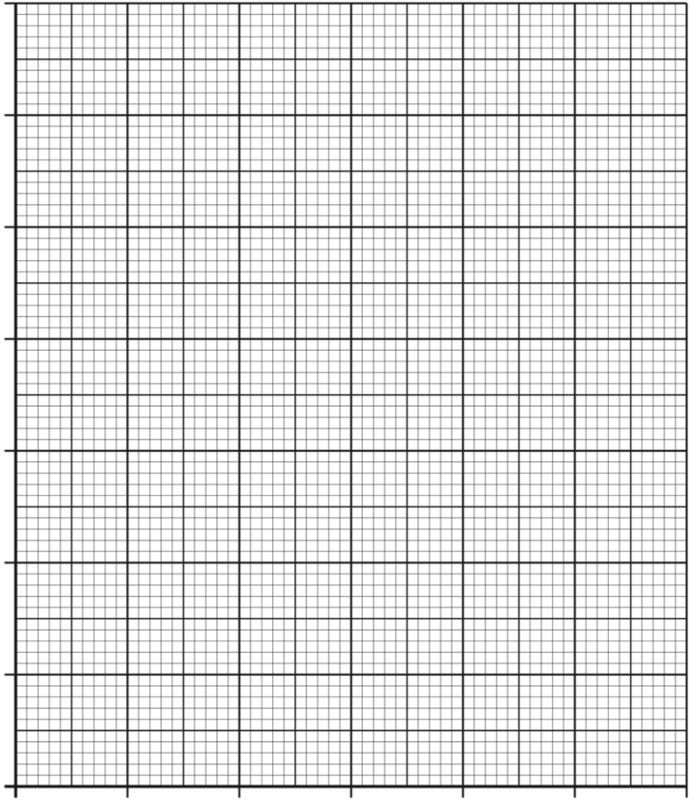


The student releases a marble from different heights on the ramp and measures the horizontal range.

The student's results are shown in the table.

Release height (m)	Horizontal range (m)
0.10	0.39
0.14	0.44
0.18	0.51
0.26	0.64
0.30	0.70

i) Using the graph paper, draw a graph of these results.
ii) Use your graph to predict the horizontal range of a marble released from a height of **0.22 m**.



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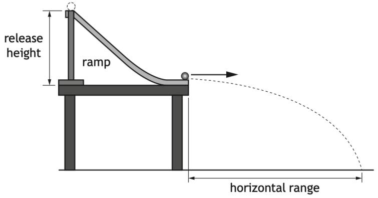

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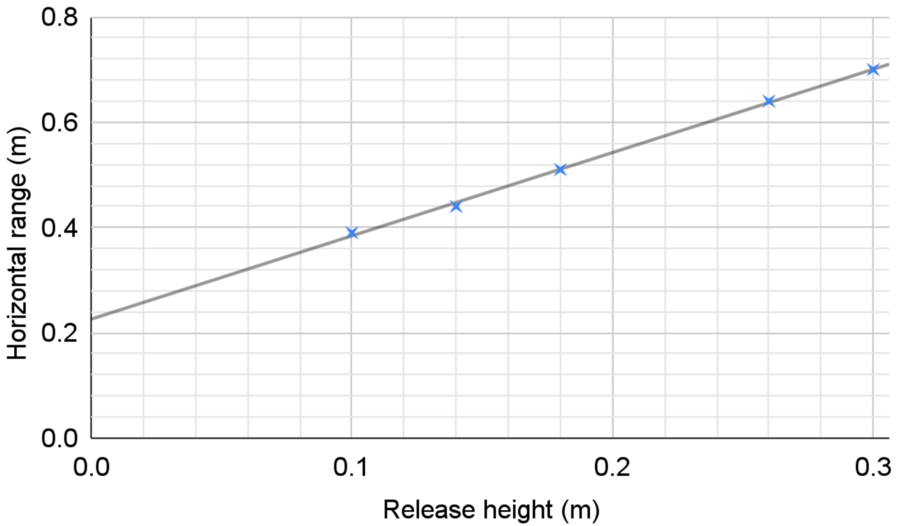


i) Suitable scales, labels, and units **(1)**

All points plotted accurately to ±half a division **(1)**

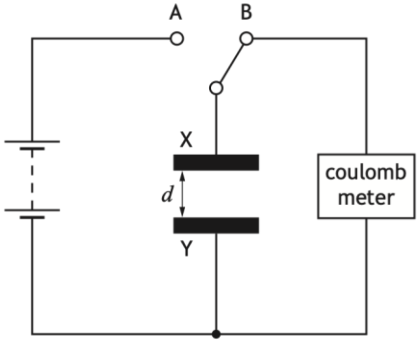
Best fit straight line **(1)**

ii) 0.57 m **(1)**

Electricity graphing

2023 Q7a

A capacitor consisting of two parallel metal plates, X and Y, is connected in a circuit as shown.

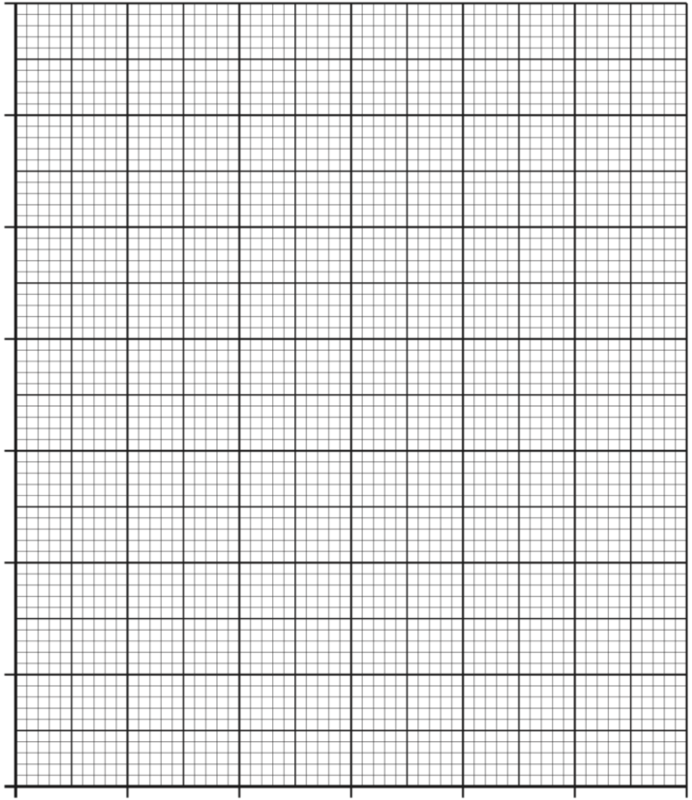


The charge Q stored on the capacitor for a range of different distances d between plate X and plate Y is shown in the table.

d (mm)	Q ($\times 10^{-12}$ C)
10	178
20	90
30	62
40	47
50	37

i) Using the graph paper, draw a graph of these results.

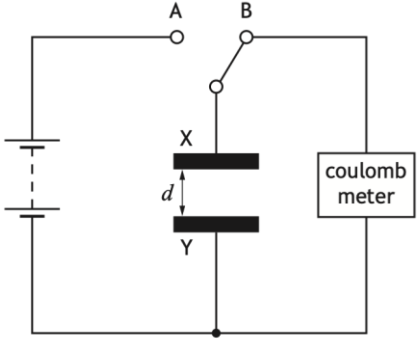
ii) Use your graph to determine the charge stored on the capacitor when the distance between plate X and plate Y is **25 mm**.



Electricity graphing

2023 Q7a

A capacitor consisting of two parallel metal plates, X and Y, is connected in a circuit as shown.



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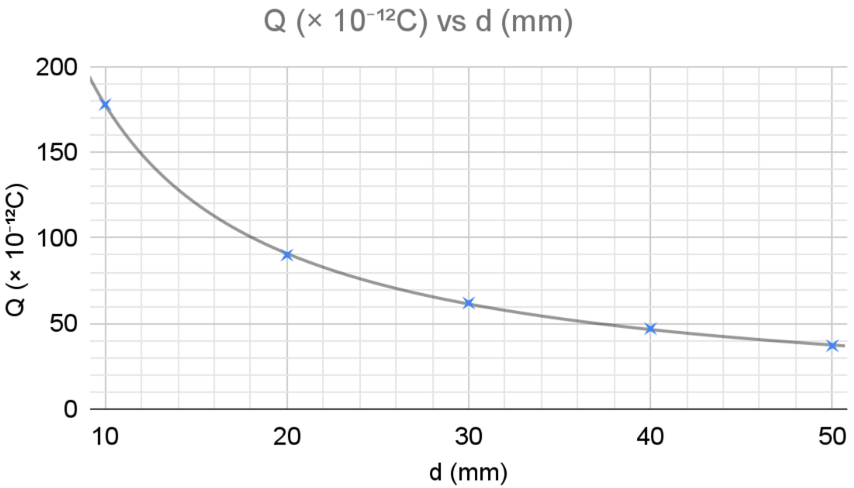
10	178
20	90
30	62
40	47
50	37

i) Using the graph paper, draw a graph of these results.

ii) Use your graph to determine the charge stored on the capacitor when the distance between plate X and plate Y is **25 mm**.



i) Suitable **scales**, **labels**, and **units (1)**

All points **plotted accurately** to ±half a division **(1)**

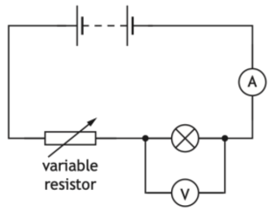
Best fit curve (1)

ii) 74 × 10^{-12} C (1)

Electricity graphing

2024 Q8a

A student sets up the following circuit to investigate the relationship between the current in and the voltage across a lamp.

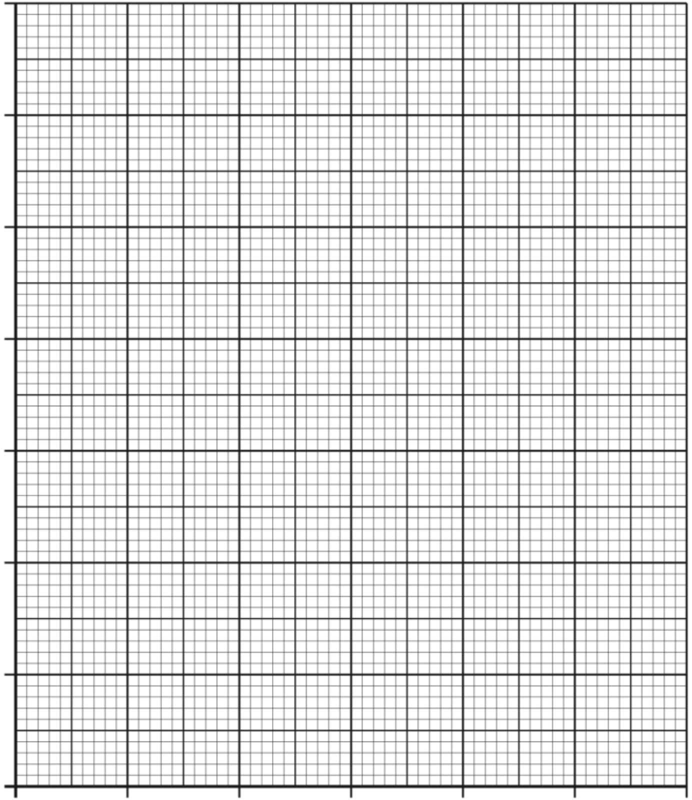


The student uses the circuit to obtain a range of measurements of current in the lamp and voltage across the lamp.
The measurements taken by the student are shown in the table.

Current (A)	Voltage (V)
0.20	0.8
0.40	2.3
0.60	4.9
0.80	8.6
0.90	11.0

i) Using the graph paper, draw a graph of the student's results.

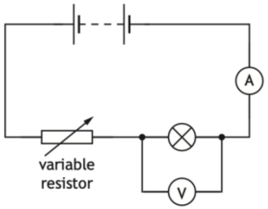
ii) Use your graph to determine the voltage across the lamp when the current in the lamp is **0.70 A.**



Electricity graphing

2024 Q8a

A student sets up the following circuit to investigate the relationship between the current in and the voltage across a lamp.

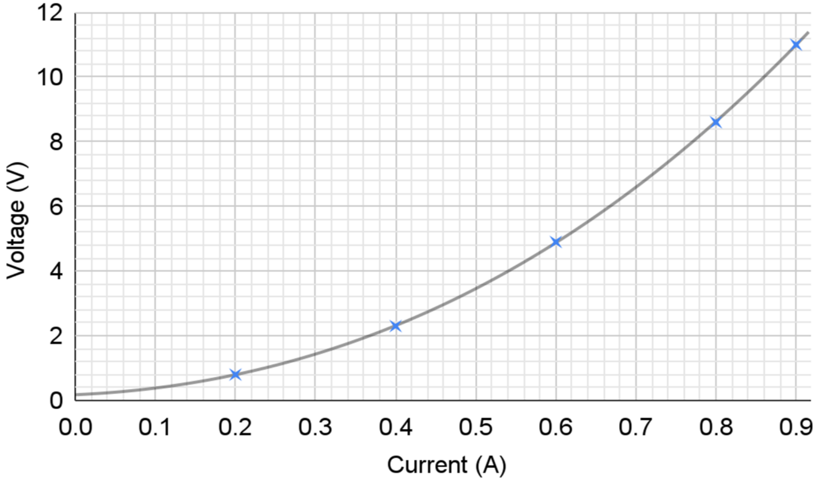


The student uses the circuit to obtain a range of measurements of current in the lamp and voltage across the lamp.
The measurements taken by the student are shown in the table.

Current (A)	Voltage (V)
0.20	0.8
0.40	2.3
0.60	4.9
0.80	8.6
0.90	11.0

i) Using the graph paper, draw a graph of the student's results.

ii) Use your graph to determine the voltage across the lamp when the current in the lamp is **0.70 A**.



i) Suitable **scales**, **labels**, and **units (1)**

All points **plotted accurately** to ±half a division **(1)**

Best fit curve (1)

ii) 6.6 V (1)

N5 Physics Revision

Past paper selector

Questions on required **experiments** (descriptions and improvements)

Questions that require **explanations**

Suggestions for **Open Ended Questions**

Questions that require **drawing graphs**

Questions on **unfamiliar Physics**

Questions that require **drawing sketches**

Dynamics

SQP Q2d

The orbital period T, in seconds, of the ISS can be calculated using the relationship

$$T = \frac{2\pi R}{v}$$

where *v* is the orbital speed in metres per second and *R* is the orbital radius in metres.

The orbital radius R is the sum of the radius of the Earth and the altitude above the surface of the Earth.

The radius of the Earth is **6·4 × 10⁶ m**.

The orbital speed of the ISS can be taken to be **7·7 × 10³ m s⁻¹**.

Calculation:
Calculate the orbital period of the ISS when it is orbiting at an altitude of **3·30 × 10⁵ m**.

$$T = \frac{2\pi R}{v}$$

$$T = \frac{2\times\pi\times(6\cdot4\times10^{6} + 3\cdot30\times10^{5})}{7\cdot7\times10^{3}} \qquad 1,1$$

$$T = 5500\ \text{s} \qquad 1$$

Dynamics

2018 Q22

The energy of a water wave can be calculated using

$$E = \frac{\rho g A^2}{2}$$

where:

E is the energy of the wave in J
ρ is the density of the water in kg m^{-3}
g is the gravitational field strength in N kg^{-1}
A is the amplitude of the wave in m.

A wave out at sea has an amplitude of 3·5 m.

The density of the sea water is $1{\cdot}02 \times 10^3$ kg m^{-3}.

Calculation:
The energy of the wave is

A $6{\cdot}2 \times 10^3$ J

B $1{\cdot}7 \times 10^4$ J

C $6{\cdot}1 \times 10^4$ J

D $1{\cdot}2 \times 10^5$ J

E $6{\cdot}1 \times 10^8$ J.

Dynamics

2020 Q4

A student designs an experiment to investigate the relationship between the extension y of a spring and the magnitude of the force *F* applied to it.

Different masses are attached to the spring and the length of the spring is recorded for each mass.

The relationship between *F* and *y* is

$$F = ky$$

where *k* is the spring constant of the spring.

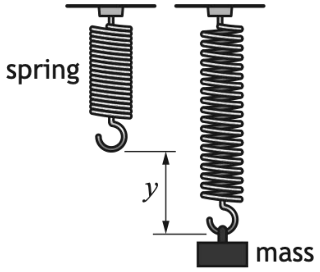
The length of the spring with no mass attached is 0·080 m

.

When a mass is attached to the spring, the length of the

spring increases to **0·110 m**.

The spring constant of the spring is **12 N m⁻¹**.



Calculation:
The magnitude of the force applied to the spring is

A	0·0025 N
B	0·36 N
C	1·3 N
D	2·3 N
E	400 N.

Dynamics

2024 Q18

The size of the buoyancy force F_b acting on an object immersed in a fluid is given by the relationship

$$F_b = \rho g V$$

where: ρ is the density of the fluid in kg m^{-3}

g is the gravitational field strength in N kg^{-1}

V is the volume of the object in m^3.

Calculation:
The volume of an object that experiences a buoyancy force of **360 N** when immersed in a fluid of density **1020 kg m^{-3}** is

A	0.036 m^3
B	0.33 m^3
C	3.5 m^3
D	28 m^3
E	37 000 m^3.

Properties of matter

2019 Q14

The pressure *p* due to a liquid at a depth *h* is given by the relationship

$$p = \rho g h$$

where ρ is the density of the liquid and g is the gravitational field strength.

A liquid has a density of 990 kg m^{-3}.

Calculation:
When the pressure due to the liquid is **1470 Pa**, the depth in the liquid is

A 0·069 m

B 0·15 m

C 0·67 m

D 1·5 m

E 6·6 m.

Properties of matter

2021 Q18

The average kinetic energy of a gas molecule can be determined using the following relationship.

$$E_k = \frac{3}{2} k_B T$$

where:

E_k is the average kinetic energy of a gas molecule in joules, J

k_B is Boltzmann's constant = **1.38×10^{-23} JK^{-1}**

T is the temperature of a gas molecule in kelvin, K.

Calculation:
The average kinetic energy of a gas molecule at **100 °C** is:

A 2.07×10^{-21} J

B 3.58×10^{-21} J

C 5.15×10^{-21} J

D 5.65×10^{-21} J

E 7.72×10^{-21} J.

Space and Cosmology

2023 Q6

The natural greenhouse effect is vital for sustaining life on Earth.

The ‘no greenhouse’ temperature is the average surface temperature of Earth if there were no natural greenhouse effect.

The ‘no greenhouse’ temperature T can be determined using the relationship

$$T^2 = 280^2 \times \sqrt{\frac{(1-\alpha)}{d^2}}$$

where: *T* is the ‘no greenhouse’ temperature in kelvin
α is the proportion of incoming solar radiation that Earth reflects
d is the mean distance from the Sun in astronomical units (AU).

Calculation:
The value of *α* for Earth is taken to be **0.290** and the mean distance from the Sun to Earth is **1.00 AU**.

The ‘no greenhouse’ temperature of Earth is

A 14.1 K

B 15.4 K

C 236 K

D 257 K

E 66 100 K.

Waves

2014 Q5

The UV Index is an international standard measurement of the intensity of ultraviolet radiation from the Sun. Its purpose is to help people to effectively protect themselves from UV rays.

UV Index	*Description*
0 – 2	Low risk from the Sun's UV rays for the average person
3 – 5	Moderate risk of harm from unprotected Sun exposure
6 – 7	High risk of harm from unprotected Sun exposure
8 – 10	Very high risk of harm from unprotected Sun exposure
11+	Extreme risk of harm from unprotected Sun exposure

The tables below give information for elevation above sea level and cloud cover.

Cloud cover	*Cloud adjustment*
Clear skies	1·00
Scattered clouds	0·89
Broken clouds	0·73
Overcast skies	0·31

Elevation above sea level (km)	*Elevation above sea level adjustment*
1	1·06
2	1·12
3	1·18

The UV index can be calculated using

$$\textit{UV index} = \left[\begin{matrix}\textit{total effect of}\\ \textit{UV radiation}\end{matrix} \times \begin{matrix}\textit{elevation above}\\ \textit{sea level adjustment}\end{matrix} \times \begin{matrix}\textit{cloud}\\ \textit{adjustment}\end{matrix}\right] \div 25$$

The UV index is then rounded to the nearest whole number.

Calculation:
At a particular location the total effect of UV radiation is **280**.
The elevation is **2 km** above sea level with overcast skies.
Calculate the **UV index** value for this location.

UV index = (280 x 1·12 x 0·31) ÷ 25 **(1)**

= 3·89
= 4 **(1)**

N5 Physics Revision

Past paper selector

Questions on required **experiments** (descriptions and improvements)

Questions that require **explanations**

Suggestions for **Open Ended Questions**

Questions that require **drawing graphs**

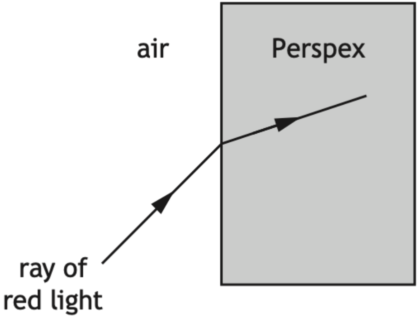
Questions on **unfamiliar Physics**

Questions that require **drawing sketches**

Normals and angles

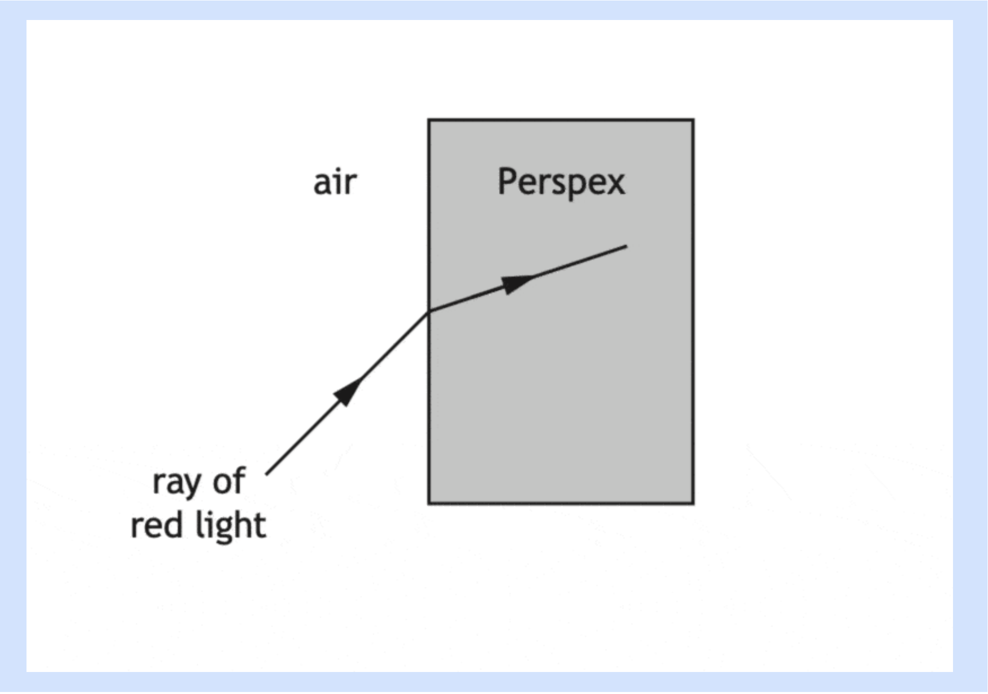
2016 Q6a

A student directs a ray of red light into a Perspex block to investigate refraction.



On the diagram, draw and label:

i. the normal; **(1)**
ii. the angle of incidence i and the angle of refraction r. **(1)**

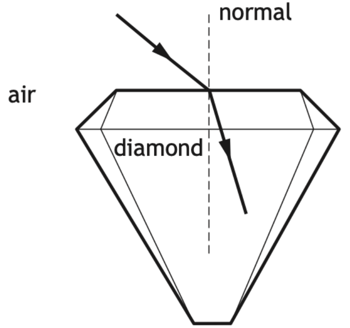


Normals and angles

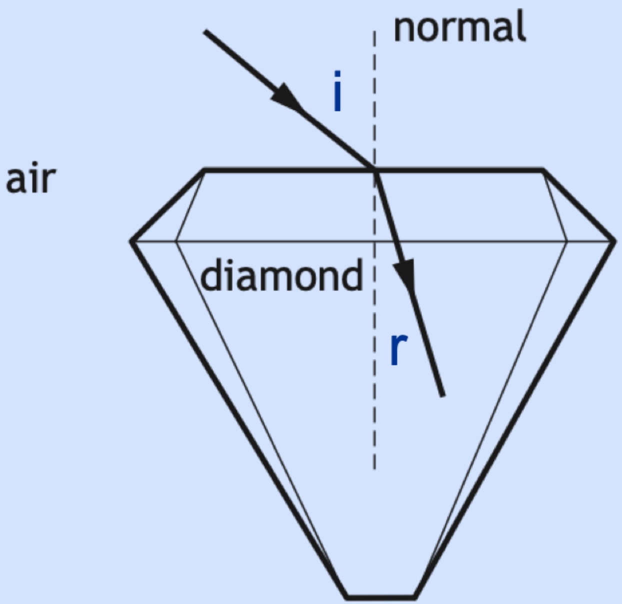
2015 Q5a

Diamonds are popular and sought after gemstones.

Light is refracted as it enters and leaves a diamond. The diagram shows a ray of light entering a diamond.



On the diagram, label the angle of incidence i and the angle of refraction r. **(1)**

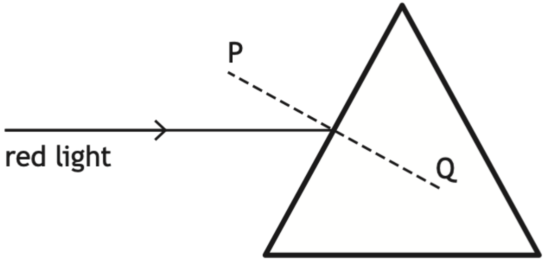


Refraction in prism

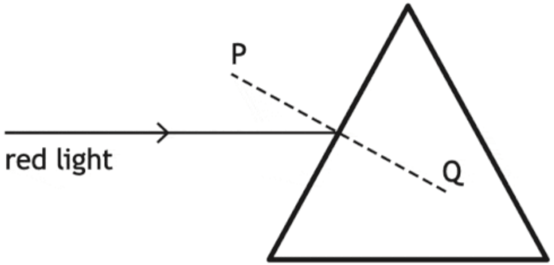
2019 Q11ai

A student carries out an experiment to investigate the effect of different shaped glass blocks on the path of a ray of light.

The student directs a ray of red light at a triangular glass block as shown.



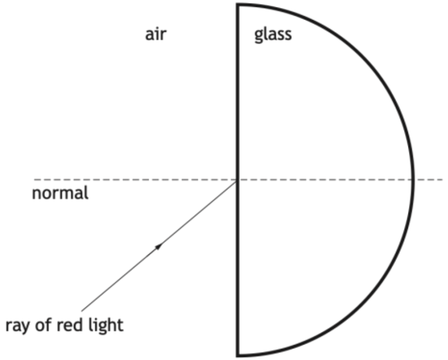
Complete the diagram above to show the path of the ray of red light through and out of the glass block. **(2)**



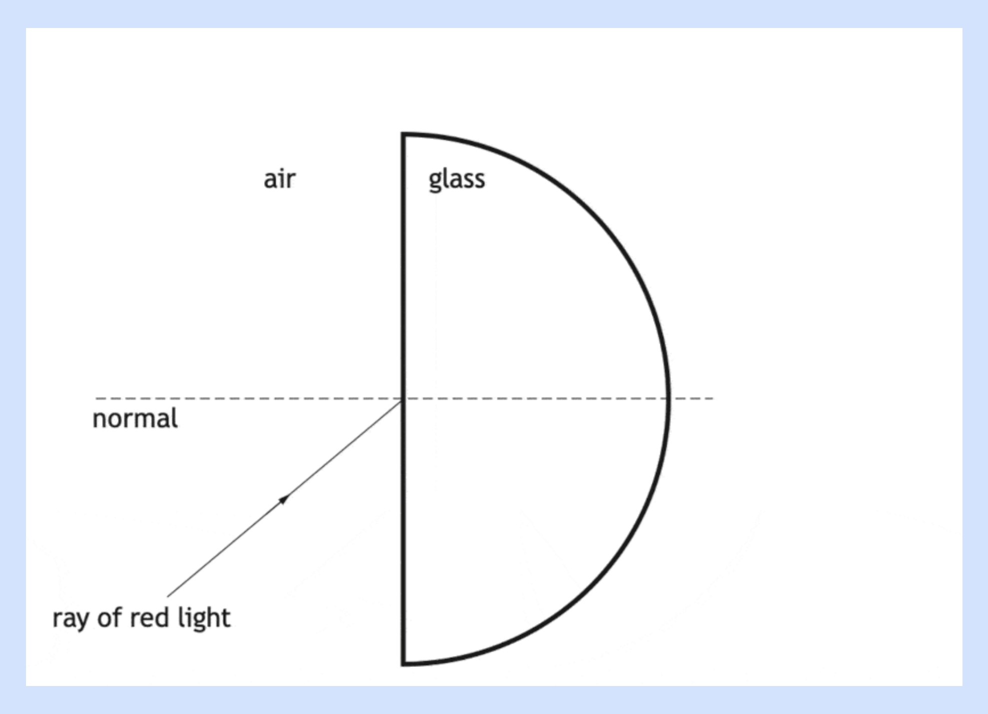
Refraction in semicircular glass block

2022 Q11a

A laser produces a narrow beam of concentrated light of one particular wavelength. A ray of red light from a laser is directed into a semi-circular glass block.



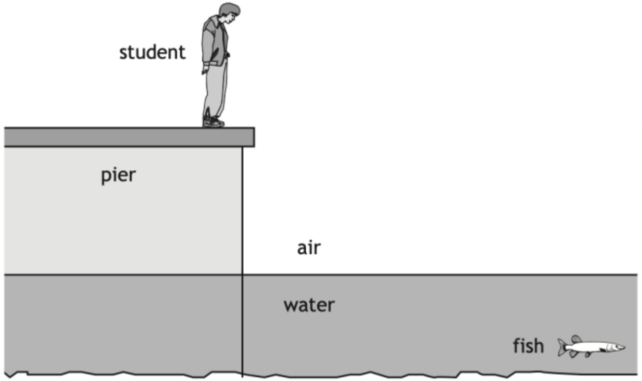
Complete the diagram to show the path of the ray of red light through and out of the semi-circular glass block. **(2)**



Refraction in semicircular glass block

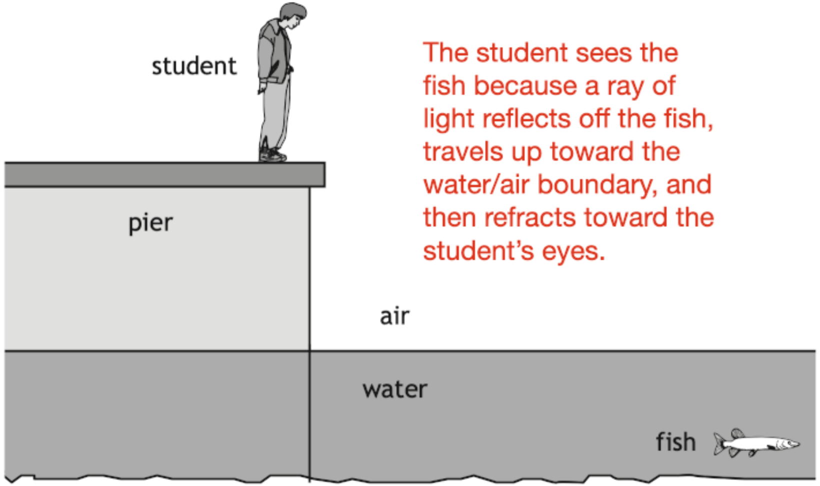
2022 Q11a

When looking down into the calm water behind the pier the student sees a fish.



Complete the diagram to show the path of a ray of light from the fish to the student.

You should include the normal in your diagram. **(3)**

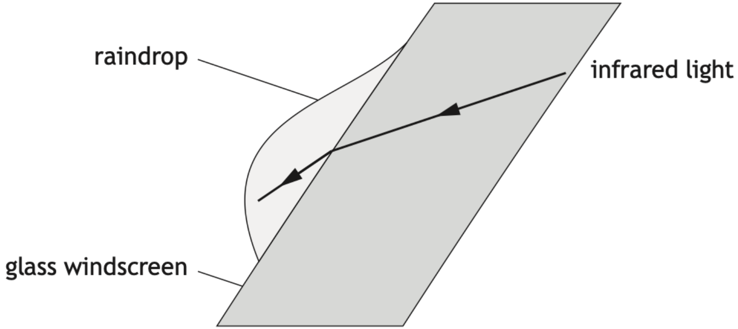


The student sees the fish because a ray of light reflects off the fish, travels up toward the water/air boundary, and then refracts toward the student's eyes.

Normals and angles

2018 11c

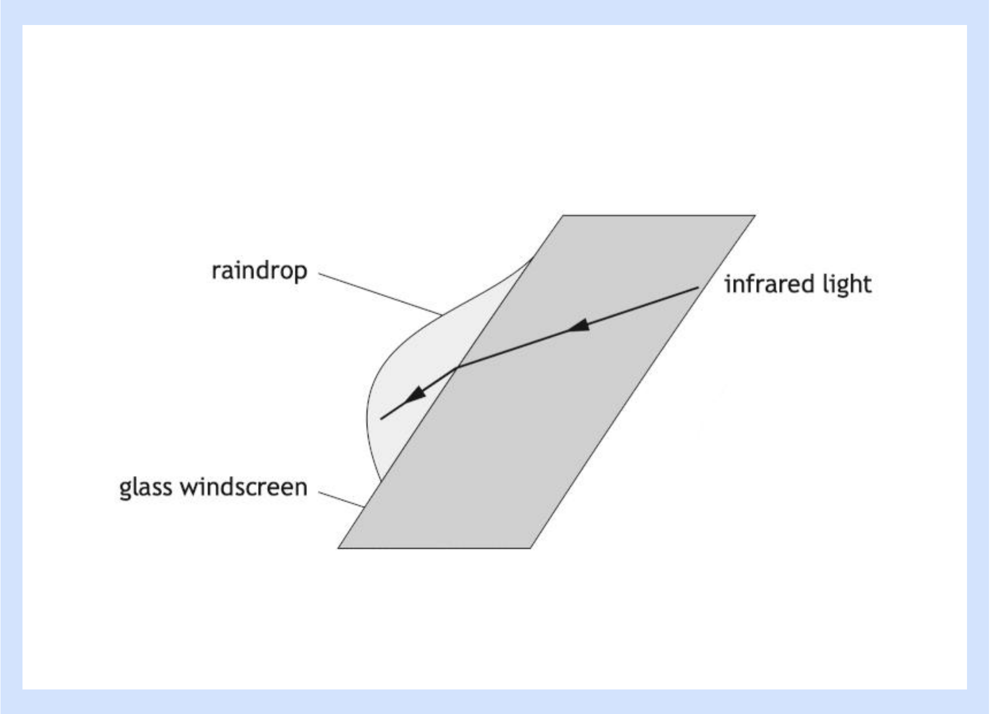
Some of the infrared light is refracted when travelling from the glass windscreen into a raindrop.



On the diagram, draw and label:

(A) a normal; **(1)**

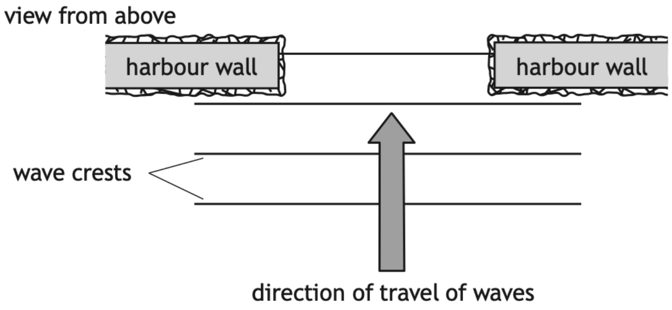
(B) an angle of incidence i and an angle of refraction r. **(1)**



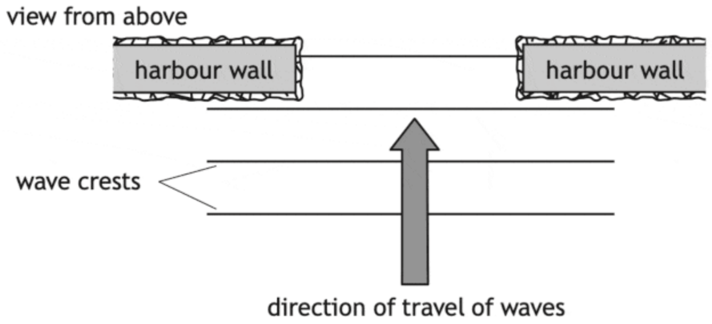
Diffraction

2017 Q4c

Waves travel towards the entrance of the harbour as shown.



Complete the diagram to show the pattern of wave crests inside the harbour. **(2)**

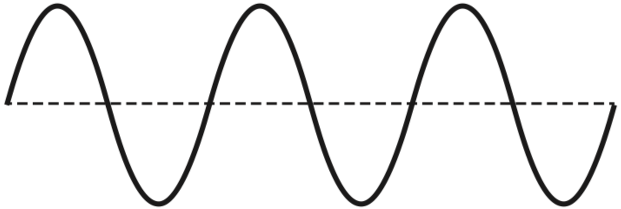


Diffraction

2020 Q11a

The student blows through the straw to produce a sound.

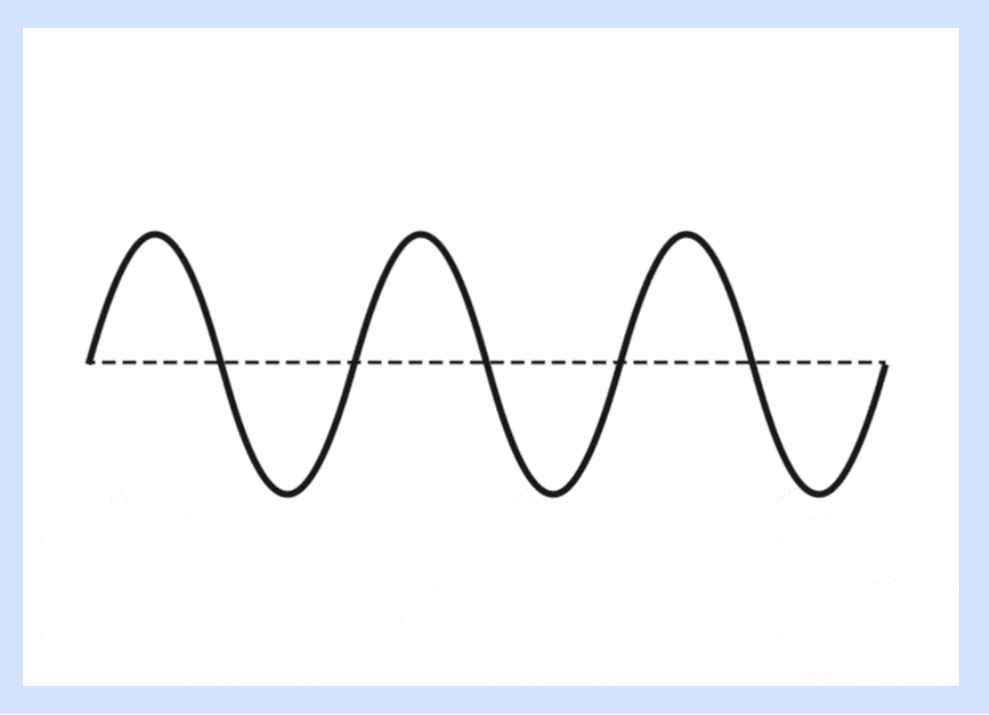
A microphone is connected to an oscilloscope. The oscilloscope displays a trace of the sound wave produced by the straw as shown.



On the trace, draw and label

(i) the amplitude **(1)**

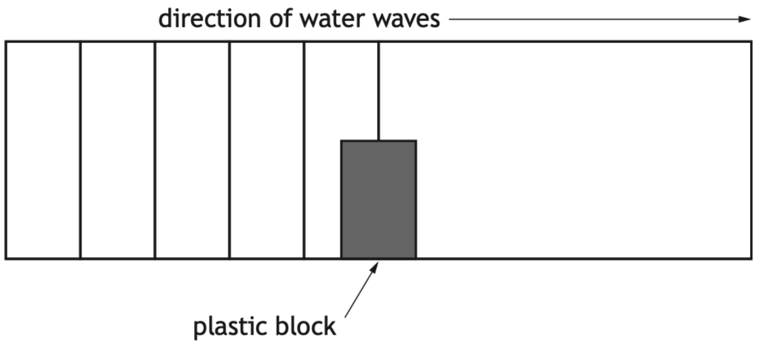
(ii) the wavelength, λ. **(1)**



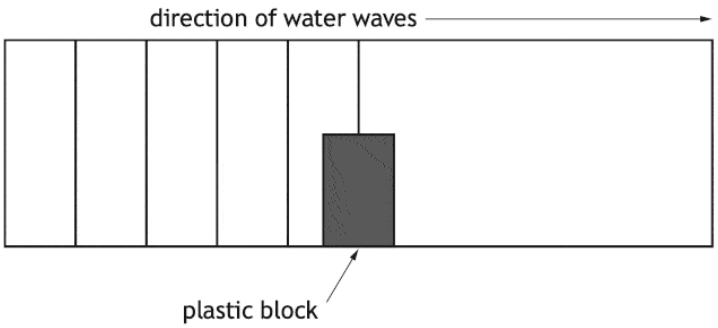
Diffraction

2022 Q10b

The student now places a plastic block in the ripple tank.



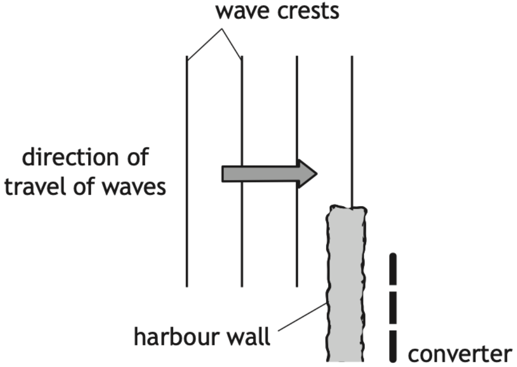
Complete the diagram to show the pattern of the water waves beyond the plastic block. **(2)**



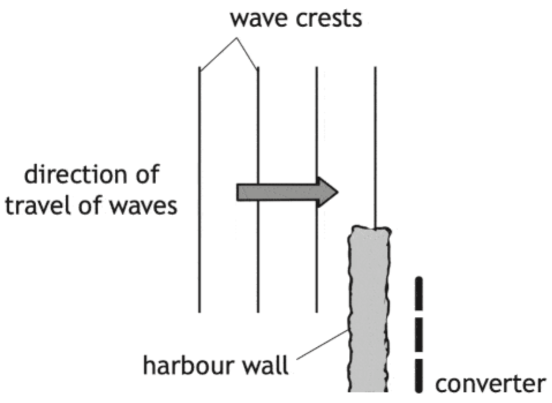
Diffraction

2024 Q11d

The wave energy converter is now moved to a position behind a harbour wall, so it can be serviced.
Waves travel towards the harbour wall, as shown.



Complete the diagram to show the pattern of the wave crests beyond the harbour wall. **(2)**

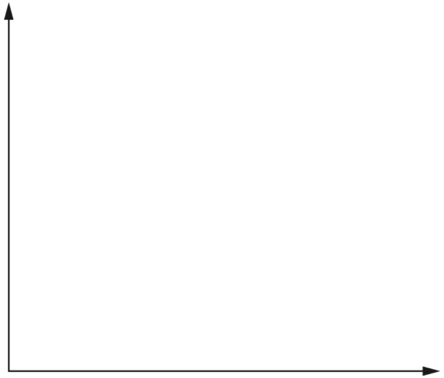


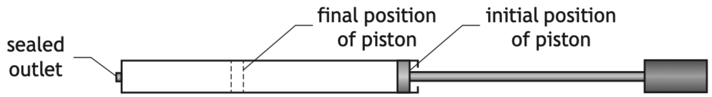
Properties of matter (pV graph)

2017 Q3c

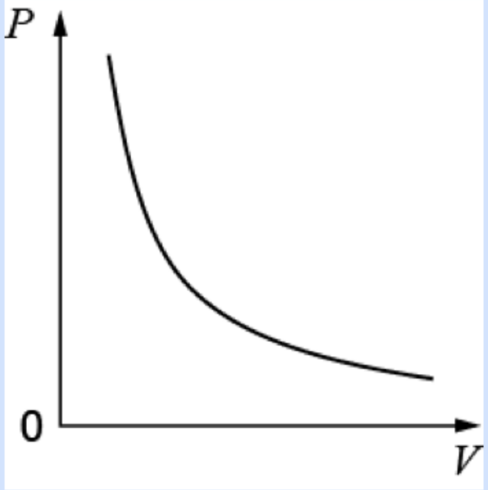
Using the axes provided, sketch a graph to show how the pressure of the air in the pump varies as its volume increases.

Numerical values are not required on either axis.





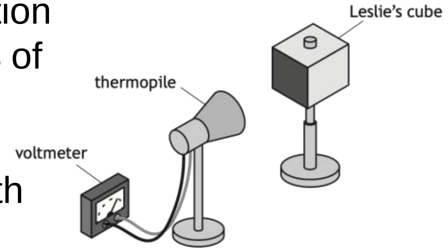
axes labelled p and V **(1)**
correct shape (curved) **(1)**



Properties of matter (pV graph)

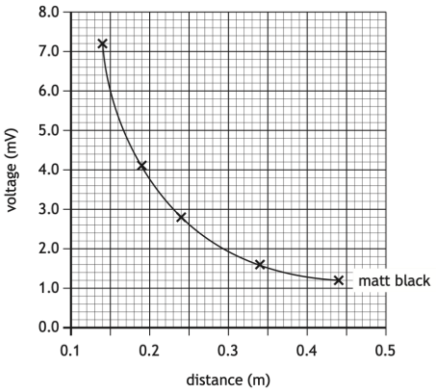
2022 Q12a(ii)

A student uses a Leslie's cube and thermopile to investigate the amount of infrared radiation emitted by different surfaces of the cube.

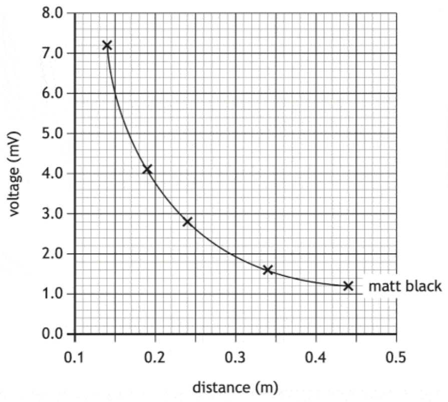


The student fills the cube with hot water and measures the amount of infrared radiation at different distances from the cube, using the thermopile.

The student produces a graph of their results for the matt black side.The experiment is repeated using the shiny silver side.



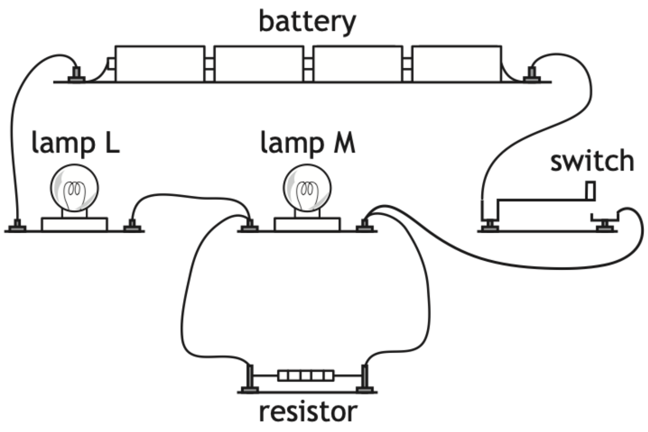
On the graph, draw a line to show how the voltage produced by the thermopile varies with distance for the shiny silver side.



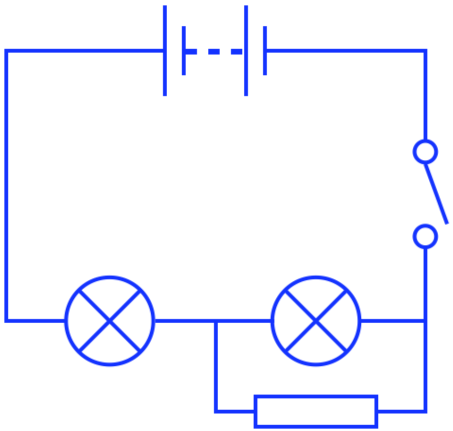
Circuit diagrams

2015 Q1a

A student sets up the following circuit using a battery, two lamps, a switch and a resistor.

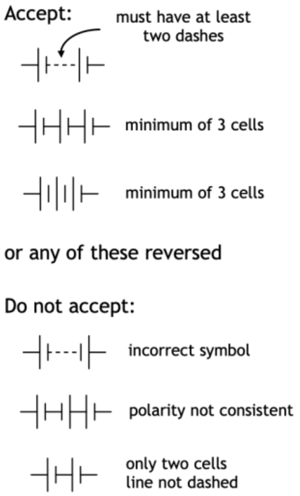


Draw a circuit diagram for this circuit using the correct symbols for the components. **(3)**

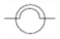


2 marks for symbols:
All correct **(2)**
At least two different symbols correct **(1)**

1 mark for correct representation of external circuit wiring **with no gaps**



Ignore any labelling.

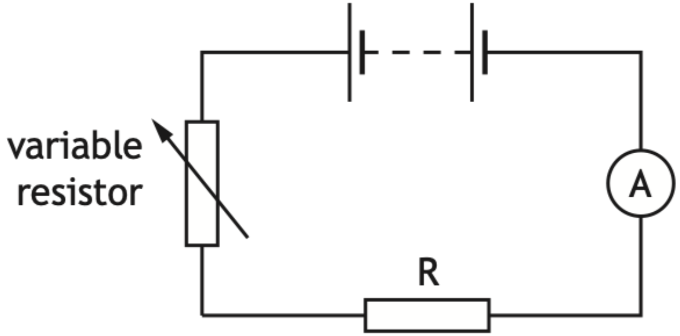
Accept  for bulb.

Accept  for resistor.

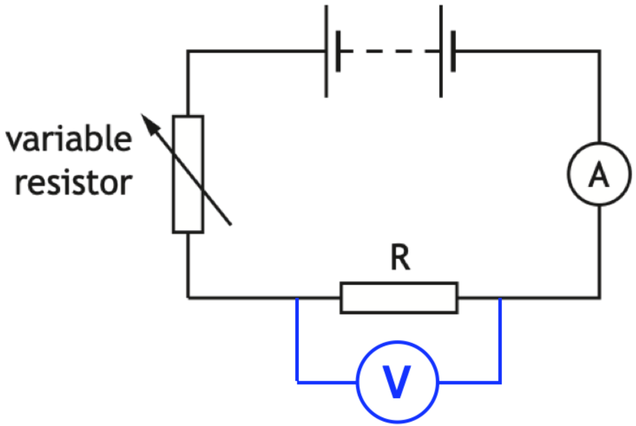
Circuit diagrams

2016 2a

A student investigates the resistance of a resistor using the circuit shown.



Complete the circuit diagram to show where a voltmeter must be connected to measure the voltage across resistor R. **(1)**



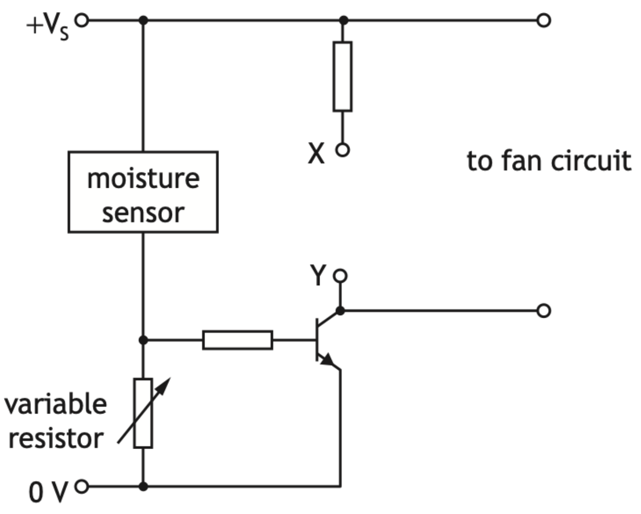
Voltmeter across resistor R
(1)

Transistor circuit with LED

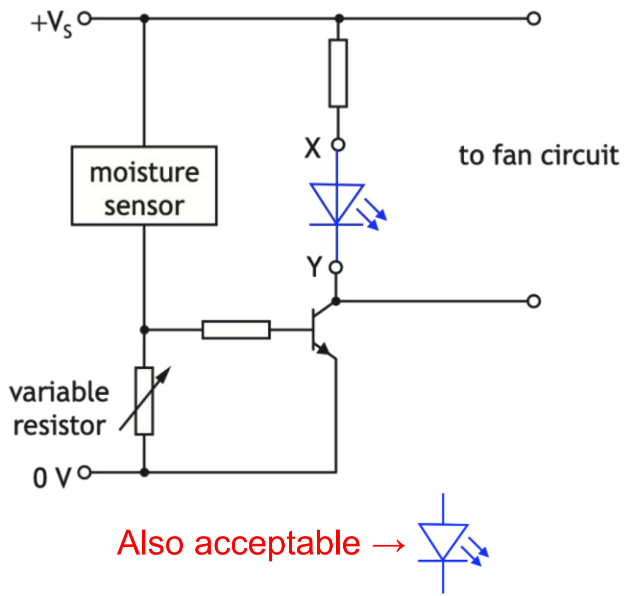
2022 Q7c(i)

The dehumidifier switches on automatically when the moisture in the air increases above a certain level. This causes an LED to light and a fan to turn on.

Part of the circuit diagram for the circuit is shown.



Complete the circuit diagram to show the LED connected correctly between X and Y. **(1)**



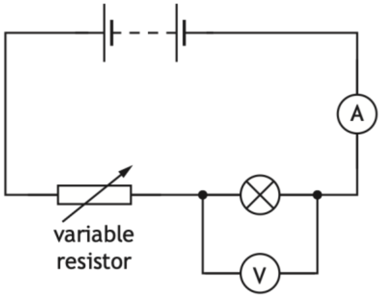
Voltage-current graph

2024 Q8b

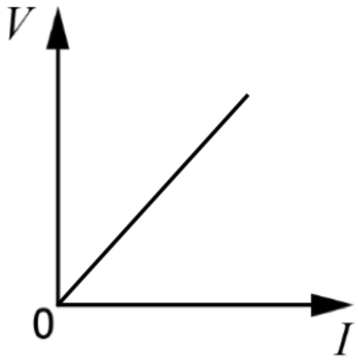
A student sets up the following circuit to investigate the relationship between the current in and the voltage across a lamp.

Part of the circuit diagram for circuit is shown.

The student then replaces the lamp in the circuit with a fixed resistor and repeats the investigation.



Using the axes, sketch a graph to show how the voltage V across the fixed resistor varies with the current I in the circuit. **(1)**



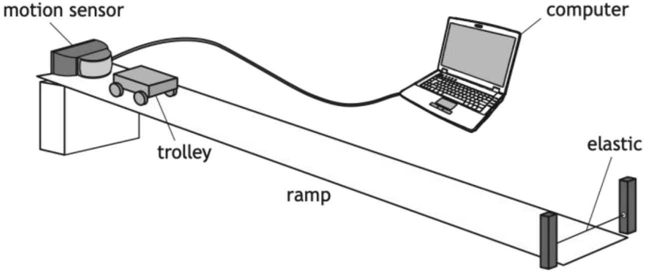
Ignore any numerical values.

Accept:
Any passably straight line that would extrapolate through the origin.

Velocity-time graph

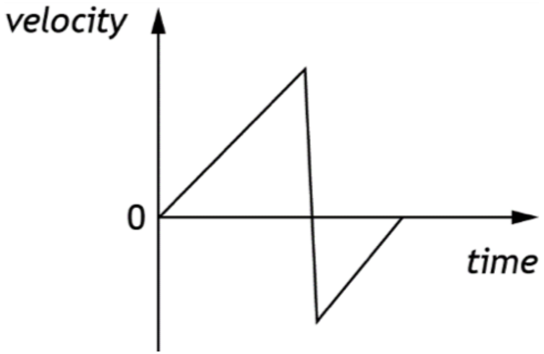
2018 Q2c

In a further experiment the second student places a piece of elastic across the bottom of the ramp as shown.



The student again releases the trolley. The trolley rolls down the ramp and rebounds from the elastic to move back up the ramp.

Using the axes provided, complete the velocity-time graph for the motion of the trolley from the moment it contacts the elastic, until it reaches its maximum height back up the ramp. **(2)**



First mark can be awarded for vertical line crossing time axis.

Ignore any numerical values.

Line should not continue beyond the time when the trolley reaches its maximum height.

Line with negative gradient to cross time axis to negative value of velocity **(1)**

Line with positive gradient to return to intercept time axis **(1)**

Velocity-time graph

2023 Q2bii

During a cycle race, a cyclist attempts to pass a water bottle to a team-mate.

The cyclist is travelling in a straight line at **12.5 ms^{-1}** when they drop the bottle. The bottle hits the ground **0.53 s** later.

A spectator at the side of the road observes the cyclist dropping the bottle.

Sketch a velocity-time graph showing the magnitude of the vertical velocity of the bottle from the time it is released until it reaches the ground.

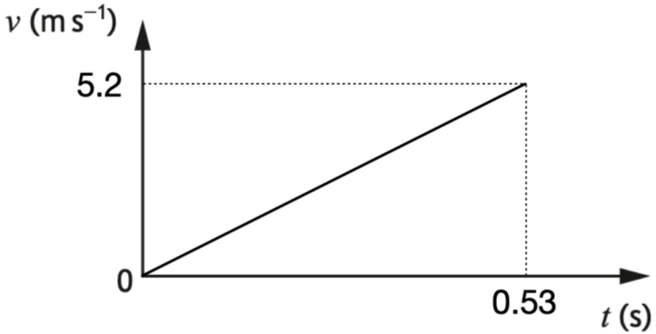
Numerical values are required on both axes. **(2)**

For numerical values must first calculate final vertical velocity

$$a = \frac{v-u}{t}$$

$$(-)9.8 = \frac{v-0}{0.53}$$

$$v = (-)5.2\ \mathrm{m\,s^{-1}}$$



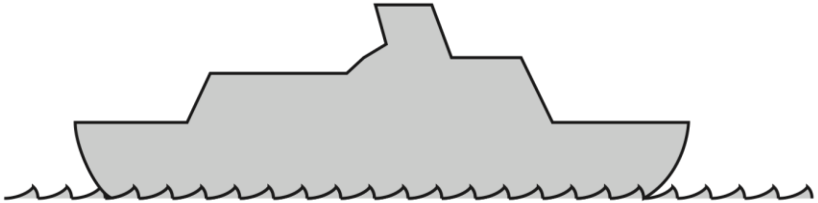
correct shape - straight line with positive gradient starting at origin **(1)**

graph ends at (**0.53**, **5.2**) **(1)**

Free body diagrams

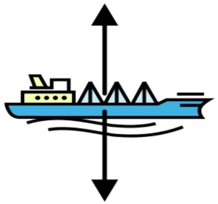
2015 Q7b

Out in the open sea the ship comes to rest.



Explain, with the aid of a labelled diagram, why the ship floats. **(3)**

buoyancy force/upthrust/force of water on ship/flotation force **(1)**



weight/force of gravity **(1)**

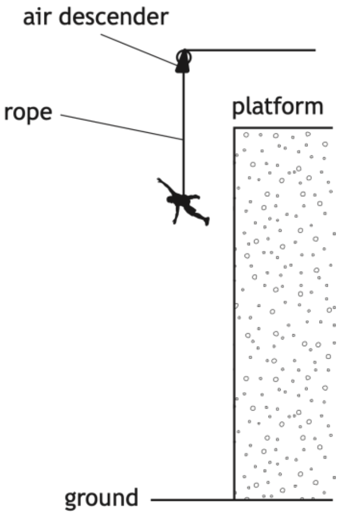
(These) **forces** are **balanced (1)**

Free body diagrams

2016 Q10c

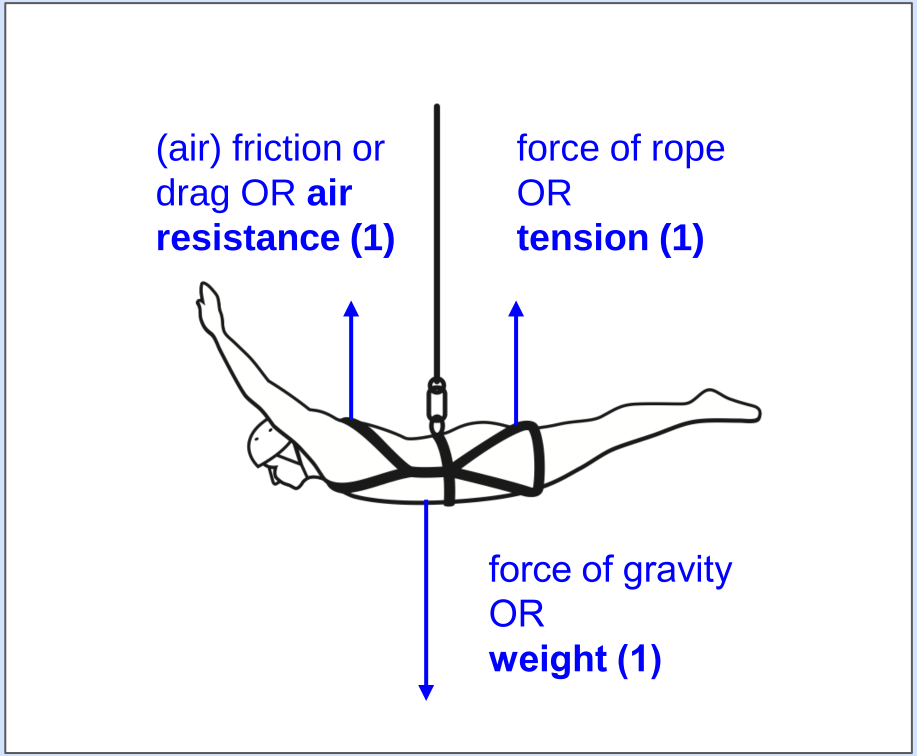
A climber, attached to an air descender by a rope, steps off the platform and drops towards the ground and lands safely.

During part of the drop the forces on the climber are balanced.



On the diagram show all the forces acting vertically on the climber during this part of the drop.

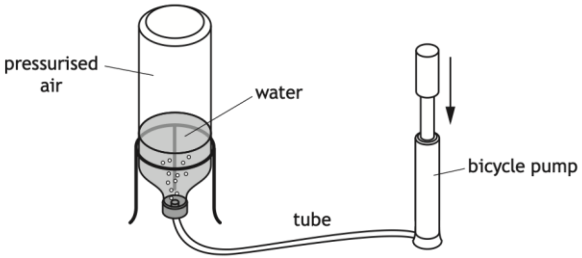
You must name these forces and show their directions. **(3)**



Free body diagrams

2019 Q8a

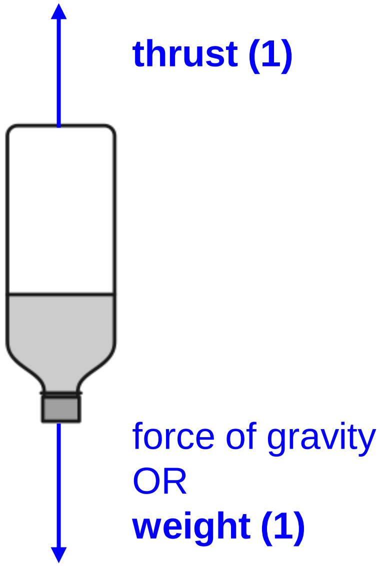
A water rocket consists of a plastic bottle partly filled with water. Air is pumped in through the water. When the pressure is great enough, the tube detaches from the bottle. Water is forced out of the bottle, which causes the bottle to be launched upwards.



On the diagram, show all the forces acting vertically on the bottle as it is launched.

You must name these forces and show their directions. **(2)**

Name and direction required for each mark.



Free body diagrams

2022 Q3(ii)

A spaceship on Mars is being prepared for the return journey to Earth.

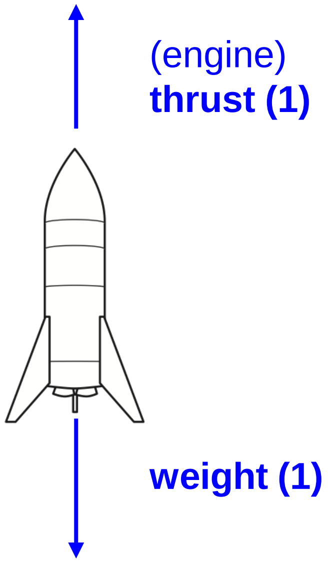
On the diagram, show all the forces acting vertically on the spaceship just after it leaves the surface.

You must name these forces and show their directions. **(2)**

(1) for each force correctly labelled with corresponding direction.

Ignore friction/air resistance/drag

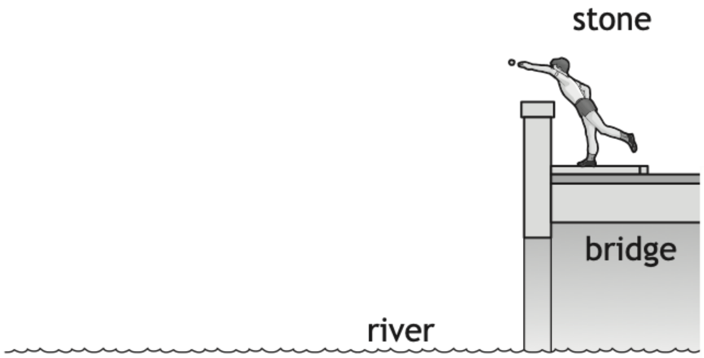
Ignore horizontal forces



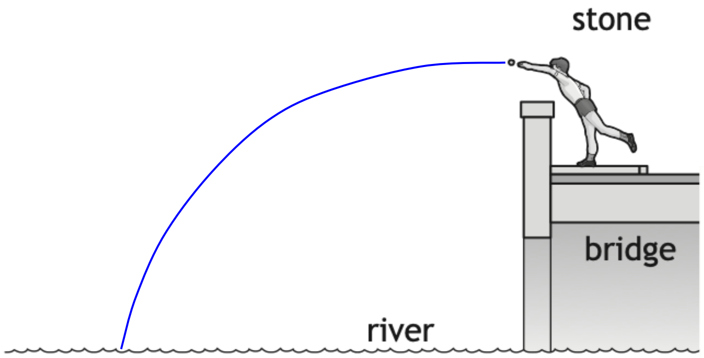
Projectiles

2015 Q9a

A child throws a stone horizontally from a bridge into a river.



On the diagram sketch the path taken by the stone between leaving the child's hand and hitting the water. **(1)**



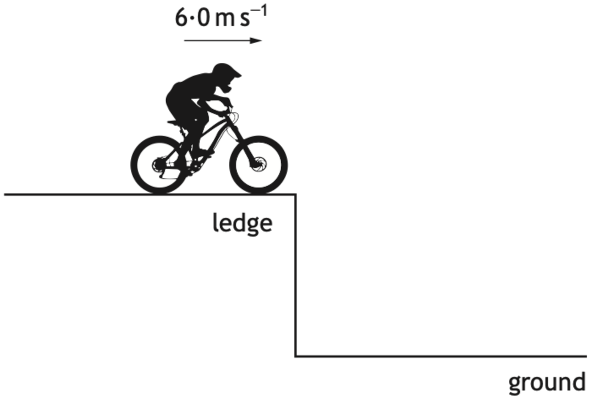
suitable curved path **(1)**

Do not accept an indication of stone rising

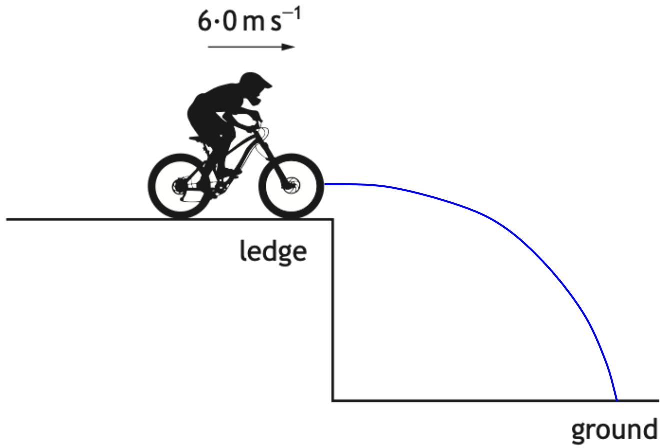
Projectiles

2018 Q3c

During part of the competition, a cyclist and bike travel horizontally at 6 m s^{-1} off a ledge as shown.



On the diagram above, sketch the path taken by the cyclist and bike between leaving the ledge and reaching the ground. **(1)**



Curved path **(1)**

Do not accept an indication of competitor and bike rising.

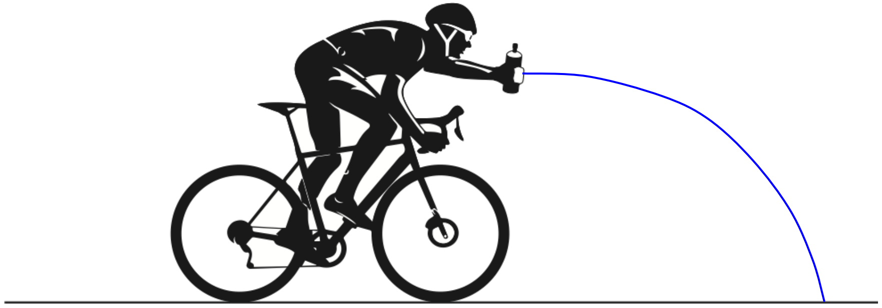
Projectiles

2023 Q2a

During a cycle race, a cyclist attempts to pass a water bottle to a team-mate. The cyclist is travelling in a straight line at 12.5 ms^{-1} when they drop the bottle. The bottle hits the ground 0.53 s later.

A spectator at the side of the road observes the cyclist dropping the bottle.

On the diagram above, sketch the path taken by the bottle from the point it is dropped, as observed by the spectator at the side of the road. **(1)**



correct curved path shown **(1)**

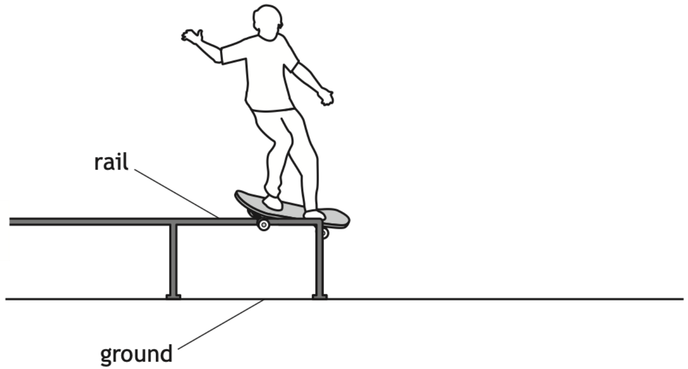
Do not accept indication of curve rising above horizontal

Projectiles

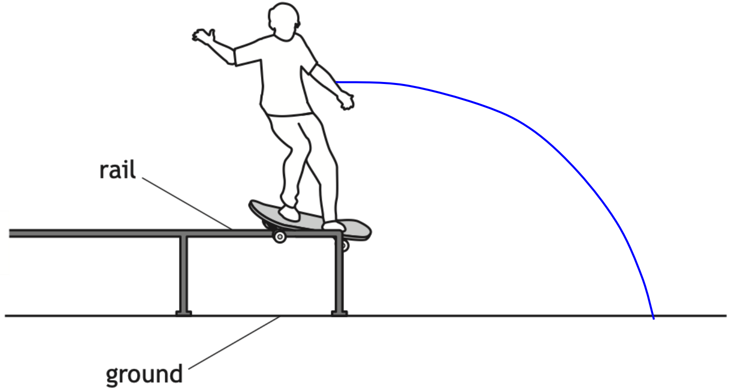
2024 Q3b

A boardslide is a common trick where a skateboarder uses the middle of the skateboard to slide along a horizontal rail. The skateboarder and board have a combined mass of 65 kg.

The skateboarder and board slide off the end of the rail.



On the diagram, sketch the path of the skateboarder and board between leaving the rail and reaching the ground. **(1)**



correct curved path shown **(1)**

Do not accept indication of curve rising above horizontal

N5 Physics Revision

Past paper selector

Questions on required **experiments** (descriptions and improvements)

Questions that require **explanations**

Suggestions for **Open Ended Questions**

Questions that require **drawing graphs**

Questions on **unfamiliar Physics**

Questions that require **drawing sketches**

← *Back to past paper selector*

Relationships sheet

Dynamics

$d = vt$

$d = \bar{v}t$

$s = vt$

$s = \bar{v}t$

$a = \frac{v-u}{t}$

$F = ma$

$W = mg$

$E_w = Fd$

$E_p = mgh$

$E_k = \frac{1}{2}mv^2$

Electricity

$Q = It$

$V = IR$

$V_2 = \left(\frac{R_2}{R_1 + R_2}\right)V_S$

$\frac{V_1}{V_2} = \frac{R_1}{R_2}$

$R_T = R_1 + R_2 + ...$

$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + ...$

$P = \frac{E}{t}$

$P = IV$

$P = I^2R$

$P = \frac{V^2}{R}$

Properties of matter

$E_h = cm\Delta T$

$E_h = ml$

$p = \frac{F}{A}$

$p_1V_1 = p_2V_2$

$\frac{p_1}{T_1} = \frac{p_2}{T_2}$

$\frac{V_1}{T_1} = \frac{V_2}{T_2}$

$\frac{pV}{T} = \text{constant}$

Radioactivity

$A = \frac{N}{t}$

$D = \frac{E}{m}$

$H = Dw_r$

$\dot{H} = \frac{H}{t}$

Waves

$f = \frac{N}{t}$

$v = f\lambda$

$T = \frac{1}{f}$

N5 Physics Revision

Past paper selector

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