



ENERGY

Practice Exam Questions

Physics
Section 1—Questions



DATA SHEET

Speed of light in materials

Material	Speed in m s^{-1}
Air	3.0×10^8
Carbon dioxide	3.0×10^8
Diamond	1.2×10^8
Glass	2.0×10^8
Glycerol	2.1×10^8
Water	2.3×10^8

Gravitational field strengths

	Gravitational field strength on the surface in N kg^{-1}
Earth	9.8
Jupiter	23
Mars	3.7
Mercury	3.7
Moon	1.6
Neptune	11
Saturn	9.0
Sun	270
Uranus	8.7
Venus	8.9

Specific latent heat of fusion of materials

Material	Specific latent heat of fusion in J kg^{-1}
Alcohol	0.99×10^5
Aluminium	3.95×10^5
Carbon Dioxide	1.80×10^5
Copper	2.05×10^5
Iron	2.67×10^5
Lead	0.25×10^5
Water	3.34×10^5

Specific latent heat of vaporisation of materials

Material	Specific latent heat of vaporisation in J kg^{-1}
Alcohol	11.2×10^5
Carbon Dioxide	3.77×10^5
Glycerol	8.30×10^5
Turpentine	2.90×10^5
Water	22.6×10^5

Speed of sound in materials

Material	Speed in m s^{-1}
Aluminium	5200
Air	340
Bone	4100
Carbon dioxide	270
Glycerol	1900
Muscle	1600
Steel	5200
Tissue	1500
Water	1500

Specific heat capacity of materials

Material	Specific heat capacity in $\text{J kg}^{-1} \text{ } ^\circ\text{C}^{-1}$
Alcohol	2350
Aluminium	902
Copper	386
Glass	500
Ice	2100
Iron	480
Lead	128
Oil	2130
Water	4180

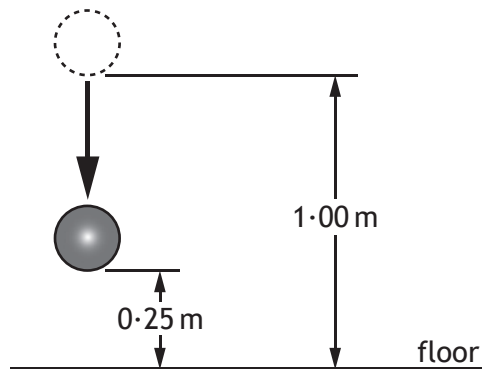
Melting and boiling points of materials

Material	Melting point in $^\circ\text{C}$	Boiling point in $^\circ\text{C}$
Alcohol	-98	65
Aluminium	660	2470
Copper	1077	2567
Glycerol	18	290
Lead	328	1737
Iron	1537	2737

Radiation weighting factors

Type of radiation	Radiation weighting factor
alpha	20
beta	1
fast neutrons	10
gamma	1
slow neutrons	3
X-rays	1

4. A ball of mass 0.50 kg is released from a height of 1.00 m and falls towards the floor.



Which row in the table shows the gravitational potential energy and the kinetic energy of the ball when it is at a height of 0.25 m from the floor?

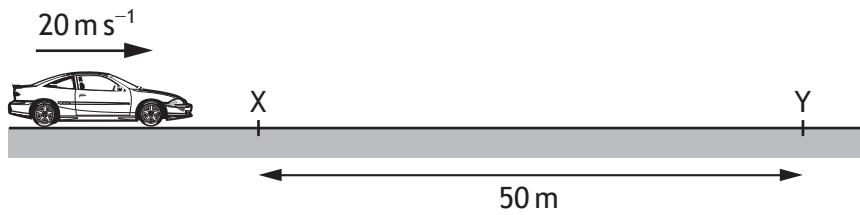
	<i>Gravitational potential energy</i> (J)	<i>Kinetic energy</i> (J)
A	0.12	0.12
B	1.2	1.2
C	1.2	3.7
D	3.7	1.2
E	4.9	1.2

16. A force of 10 N acts on an object for 2 s .
During this time the object moves a distance of 3 m .
The work done on the object is

- A 6.7 J
- B 15 J
- C 20 J
- D 30 J
- E 60 J .

16. A car of mass 1200 kg is travelling along a straight level road at a constant speed of 20 m s^{-1} .

The driving force on the car is 2500 N. The frictional force on the car is 2500 N.



The work done moving the car between point X and point Y is

- A 0 J
- B 11 800 J
- C 125 000 J
- D 240 000 J
- E 250 000 J.

16. A cyclist is travelling at 10 m s^{-1} along a level road.

The cyclist applies the brakes and comes to rest in a time of 5 s.

The combined mass of the cycle and cyclist is 80 kg.

The maximum energy converted to heat by the brakes is

- A 160 J
- B 400 J
- C 800 J
- D 4000 J
- E 8000 J.



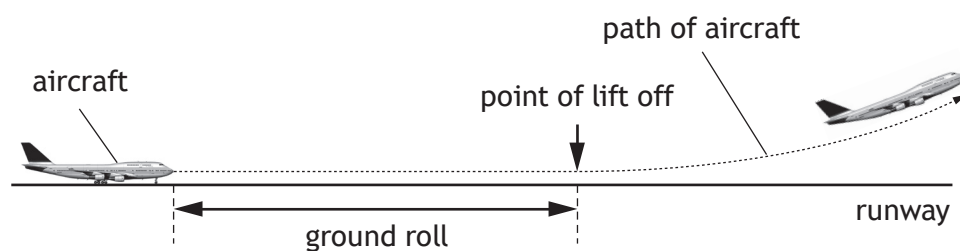
ENERGY

Practice Questions

**Physics
Section 2**



11. 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.



Physics Relationships Sheet

$$E_p = mgh$$

$$d = vt$$

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

$$v = f\lambda$$

$$Q = It$$

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

$$V = IR$$

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

$$R_T = R_1 + R_2 + \dots$$

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

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

$$H = Dw_R$$

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

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

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

$$s = vt$$

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

$$d = \overline{v}t$$

$$P = IV$$

$$s = \overline{v}t$$

$$P = I^2 R$$

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

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

$$W = mg$$

$$E_h = cm\Delta T$$

$$F = ma$$

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

$$E_w = Fd$$

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

$$E_h = ml$$

$$p_1V_1 = p_2V_2$$

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

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

Additional Relationships

Circle

$$\text{circumference} = 2\pi r$$

$$\text{area} = \pi r^2$$

Sphere

$$\text{area} = 4\pi r^2$$

$$\text{volume} = \frac{4}{3}\pi r^3$$

Trigonometry

$$\sin \theta = \frac{\text{opposite}}{\text{hypotenuse}}$$

$$\cos \theta = \frac{\text{adjacent}}{\text{hypotenuse}}$$

$$\tan \theta = \frac{\text{opposite}}{\text{adjacent}}$$

$$\sin^2 \theta + \cos^2 \theta = 1$$

Electron Arrangements of Elements

Group 1 Group 2

(1)

1 H 1	4 He 2
Hydrogen	(2)
3 Li 2, 1	4 Be 2, 2
Lithium	Beryllium
11 Na 2, 8, 1	12 Mg 2, 8, 2
Sodium	Magnesium
19 K 2, 8, 8, 1	20 Ca 2, 8, 8, 2
Potassium	Calcium
37 Rb 2, 8, 18, 8, 1	38 Sr 2, 8, 18, 8, 2
Rubidium	Strontium
55 Cs 2, 8, 18, 18, 8, 1	56 Ba 2, 8, 18, 18, 8, 2
Caesium	Barium
87 Fr 2, 8, 18, 32, 18, 8, 1	88 Ra 2, 8, 18, 32, 18, 8, 2
Francium	Radium

Key

Atomic number
Symbol
Electron arrangement
Name

Transition Elements

(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
21 Sc 2, 8, 9, 2	22 Ti 2, 8, 10, 2	23 V 2, 8, 11, 2	24 Cr 2, 8, 13, 1	25 Mn 2, 8, 13, 2	26 Fe 2, 8, 14, 2	27 Co 2, 8, 15, 2	28 Ni 2, 8, 16, 2	29 Cu 2, 8, 18, 1	30 Zn 2, 8, 18, 2
Scandium	Titanium	Vanadium	Chromium	Manganese	Iron	Cobalt	Nickel	Copper	Zinc
39 Y 2, 8, 18, 9, 2	40 Zr 2, 8, 18, 10, 2	41 Nb 2, 8, 18, 12, 1	42 Mo 2, 8, 18, 13, 1	43 Tc 2, 8, 18, 13, 2	44 Ru 2, 8, 18, 15, 1	45 Rh 2, 8, 18, 16, 1	46 Pd 2, 8, 18, 18, 0	47 Ag 2, 8, 18, 18, 1	48 Cd 2, 8, 18, 18, 2
Yttrium	Zirconium	Niobium	Molybdenum	Technetium	Ruthenium	Rhodium	Palladium	Silver	Cadmium
57 La 2, 8, 18, 18, 9, 2	72 Hf 2, 8, 18, 32, 10, 2	73 Ta 2, 8, 18, 32, 11, 2	74 W 2, 8, 18, 32, 12, 2	75 Re 2, 8, 18, 32, 13, 2	76 Os 2, 8, 18, 32, 14, 2	77 Ir 2, 8, 18, 32, 15, 2	78 Pt 2, 8, 18, 32, 17, 1	79 Au 2, 8, 18, 32, 18, 1	80 Hg 2, 8, 18, 32, 18, 2
Lanthanum	Hafnium	Tantalum	Tungsten	Rhenium	Osmium	Iridium	Platinum	Gold	Mercury
89 Ac 2, 8, 18, 32, 18, 9, 2	104 Rf 2, 8, 18, 32, 32, 10, 2	105 Db 2, 8, 18, 32, 32, 11, 2	106 Sg 2, 8, 18, 32, 32, 12, 2	107 Bh 2, 8, 18, 32, 32, 13, 2	108 Hs 2, 8, 18, 32, 32, 14, 2	109 Mt 2, 8, 18, 32, 32, 15, 2	110 Ds 2, 8, 18, 32, 32, 17, 1	111 Rg 2, 8, 18, 32, 32, 18, 1	112 Cn 2, 8, 18, 32, 32, 18, 2
Actinium	Rutherfordium	Dubnium	Seaborgium	Bohrium	Hassium	Meitnerium	Darmstadtium	Roentgenium	Copernicium

2 He 2	10 Ne 2, 8
Helium	Neon
5 B 2, 3	6 C 2, 4
Boron	Carbon
13 Al 2, 8, 3	14 Si 2, 8, 4
Aluminium	Silicon
31 Ga 2, 8, 18, 3	32 Ge 2, 8, 18, 4
Gallium	Germanium
49 In 2, 8, 18, 18, 3	50 Sn 2, 8, 18, 18, 4
Indium	Tin
81 Tl 2, 8, 18, 32, 18, 3	82 Pb 2, 8, 18, 32, 18, 4
Thallium	Lead
83 Bi 2, 8, 18, 32, 18, 5	84 Po 2, 8, 18, 32, 18, 6
Bismuth	Polonium
51 Sb 2, 8, 18, 18, 5	52 Te 2, 8, 18, 18, 6
Antimony	Tellurium
85 I 2, 8, 18, 18, 7	86 Xe 2, 8, 18, 18, 8
Iodine	Xenon
35 Br 2, 8, 18, 7	36 Kr 2, 8, 18, 8
Bromine	Krypton
33 As 2, 8, 18, 5	34 Se 2, 8, 18, 6
Arsenic	Selenium
31 Ga 2, 8, 18, 3	32 Ge 2, 8, 18, 4
Gallium	Germanium
7 N 2, 5	8 O 2, 6
Nitrogen	Oxygen
15 P 2, 8, 5	16 S 2, 8, 6
Phosphorus	Sulfur
17 Cl 2, 8, 7	18 Ar 2, 8, 8
Chlorine	Argon
9 F 2, 7	10 Ne 2, 8
Fluorine	Neon
13 Al 2, 8, 3	14 Si 2, 8, 4
Aluminium	Silicon
5 B 2, 3	6 C 2, 4
Boron	Carbon
2 He 2	10 Ne 2, 8
Helium	Neon

(18)

Group 3 Group 4 Group 5 Group 6 Group 7 Group 0

Lanthanides

57 La 2, 8, 18, 18, 9, 2	58 Ce 2, 8, 18, 20, 8, 2	59 Pr 2, 8, 18, 21, 8, 2	60 Nd 2, 8, 18, 22, 8, 2	61 Pm 2, 8, 18, 23, 8, 2	62 Sm 2, 8, 18, 24, 8, 2	63 Eu 2, 8, 18, 25, 8, 2	64 Gd 2, 8, 18, 25, 9, 2	65 Tb 2, 8, 18, 27, 8, 2	66 Dy 2, 8, 18, 28, 8, 2	67 Ho 2, 8, 18, 29, 8, 2	68 Er 2, 8, 18, 30, 8, 2	69 Tm 2, 8, 18, 31, 8, 2	70 Yb 2, 8, 18, 32, 8, 2	71 Lu 2, 8, 18, 32, 9, 2
Lanthanum	Cerium	Praseodymium	Neodymium	Promethium	Samarium	Europium	Gadolinium	Terbium	Dysprosium	Holmium	Erbium	Thulium	Ytterbium	Lutetium

Actinides

89 Ac 2, 8, 18, 32, 18, 9, 2	90 Th 2, 8, 18, 32, 18, 10, 2	91 Pa 2, 8, 18, 32, 20, 9, 2	92 U 2, 8, 18, 32, 21, 9, 2	93 Np 2, 8, 18, 32, 22, 9, 2	94 Pu 2, 8, 18, 32, 24, 8, 2	95 Am 2, 8, 18, 32, 25, 8, 2	96 Cm 2, 8, 18, 32, 25, 9, 2	97 Bk 2, 8, 18, 32, 27, 8, 2	98 Cf 2, 8, 18, 32, 28, 8, 2	99 Es 2, 8, 18, 32, 29, 8, 2	100 Fm 2, 8, 18, 32, 30, 8, 2	101 Md 2, 8, 18, 32, 31, 8, 2	102 No 2, 8, 18, 32, 32, 8, 2	103 Lr 2, 8, 18, 32, 32, 9, 2
Actinium	Thorium	Protactinium	Uranium	Neptunium	Plutonium	Americium	Curium	Berkelium	Californium	Einsteinium	Fermium	Mendelevium	Nobelium	Lawrencium