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Space Exploration	
7.1	I have a basic understanding of the Universe https://map.gsfc.nasa.gov/universe/uni_life.html
7.1.1	Write a paragraph explaining our current understanding of the Universe. *Reference correctly any source used- **DO NOT COPY**, **practice referencing and using sources for your assignment**.*
7.2	I can use the following terms correctly and in context: planet, dwarf planet, moon, Sun, asteroid, solar system, star, exoplanet, galaxy, and universe.
7.2.1	List the following in order of decreasing size: *planet, dwarf planet, moon, sun, asteroid, solar system, star, exoplanet, galaxy, universe.*
7.2.2	Define each of the following terms: *planet, dwarf planet, moon, sun, asteroid, solar system, star, exoplanet, galaxy, universe.*
7.3	I am aware of the benefits of satellites.
7.3.1	Give some uses of satellites placed in orbit above the Earth.
7.3.2	Explain how the force of gravity keeps a satellite in orbit.
7.3.3	Two examples of satellites placed in space are the ISS and the Hubble Telescope. For **each** of these satellites: a) State the purpose for it being placed in orbit. b) Describe when the satellite was placed in orbit c) How has our understanding of our Universe altered due to research from the satellite?
7.4	I know the period and orbital height of a geostationary satellite.
7.4.1	Define the term geostationary or geosynchronous orbit.
7.4.2	State the height, above the Earth's surface of a satellite placed in geostationary orbit.
7.4.3	State the time taken for a geostationary satellite to orbit the Earth.
7.4.4	State the period of a geostationary satellite.
7.4.5	State above which part of the Earth's surface geostationary satellites are placed.
7.5	I know that the period of a satellite changes with altitude.
7.5.1	Explain the term period of a satellite.

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7.5.2	Explain how the period of a satellite changes with the height above the Earth's surface.
7.5.3	Does the height of the satellite above any planet affect the period?
7.6	I am aware of the challenges of space travel.
7.6.1	Describe some of the challenges on space travel, including the following a) take off b) during flight c) being in "zero gravity" d) during re-entry *make sure you answer in terms of PHYSICS*
7.6.2	A meteorite has a mass of 1.45kg and enters the Earth's atmosphere with a speed of 10km/s. (i) Calculate the initial kinetic energy of the meteorite (ii) A few seconds later its velocity is only 200m/s. State what causes it to slow down. (iii) Determine the new kinetic energy of the meteorite (iv) The meteorite heats up from -220°C to 3550°C in the process. If it has a specific heat capacity of 800J/kg°C, Calculate the heat energy produced (v) State what happens to the rest of the kinetic energy as the meteorite passes through the atmosphere.
7.6.3	During splashdown, the 350kg Apollo space craft fell 500m at a steady speed, supported by its parachute. Calculate (i) the loss of gravitational potential energy, (ii) the work done by the parachute, and (iii) the force produced by the parachute.
7.6.4	(a) Why do spacecraft heat up on re-entry? (b) Where does the energy come from which causes this heating?
7.7	I am aware of potential space travel across large distances using ion drive.
7.7.1	Explain the term "ion drive" in attaining high velocities in space craft
7.7.2	Draw a labelled diagram to show an ion drive used to propel spacecraft over long distances.
7.7.3	State which of Newton's three laws of motion suggests that ion drive would work.
7.7.4	Summarise the video clip https://www.youtube.com/watch?v=6H0qsqZjLW0
7.8	I have a basic awareness that travelling large distances through space using a 'catapult' method.

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7.8.1	Explain the term “catapult” method in terms of spacecraft. (watch the following to help you https://www.youtube.com/watch?v=xJmD_1kSa3I)
7.8.2	Explain how the catapult method reduced the fuel requirements for the Voyager spacecraft as it left the Earth’s surface.
7.8.3	Draw a diagram to show a spacecraft using the catapult method to increase velocity.
7.9	I have a basic awareness of how astronauts manoeuvre a spacecraft in a zero friction environment, possibly to dock with the ISS
7.9.1	Explain why a rocket motor does not necessarily need to be kept on during an interplanetary flight.
7.9.2	OEQ: A student stated “If there is no friction in space, how do the thrusters work on space shuttle? Don't they have to push against something to move, like air?” Use your knowledge of Physics comment on this statement.
7.9.3	Explain the manoeuvres required by a supply craft docking with the ISS.
7.10	I have a basic awareness of maintaining sufficient energy to operate life support systems in a spacecraft.
7.10.1	List uses of energy to operate life with a human crew on a trip to Mars.
7.10.2	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. Suggest one solution to this challenge.
7.10.3	Explain the potential difficulties of supporting a crew on a trip to visit Pluto or other astronomical objects further out in our solar system.
7.11	I can describe the risks associated with manned space exploration.
7.11.1	State the challenges of space travel to Mars.
7.11.2	Explain some potential solutions to the challenges listed above.
7.12	I have knowledge of Newton’s second and third laws and their application to space travel, rocket launch and landing.
7.12.1	a) State Newton’s second law of motion. b) State Newton’s third law of motion.
7.12.2	Explain, in terms of forces, how a rocket works.
7.12.3	In terms of Newton's third law, what is the 'equal and opposite force' in each of these situations:- (i) A ship’s propeller pushes on the water, (ii) A rocket pushes on the exhaust gases, (iii) The Earth's gravity pulls on the moon, (iv) The Earth’s gravity pulls on a box sitting on the floor.

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7.12.4	A rocket has a total mass of 500kg and produces a thrust of 10000N. (i) Calculate the initial acceleration of the rocket (ii) State what happens to the mass of the rocket as it burns its fuel. (iii) If the thrust remains constant, state what happens to the acceleration of the rocket.
7.12.5	An astronaut uses a backpack called a Man Manoeuvring Unit, or MMU, to move her around when in space. This produces a thrust of 2.0 N in any direction. If the astronaut and her suit has a mass of 180kg, (i) Calculate the initial acceleration the astronaut using this MMU. (ii) The astronaut is initially at rest, calculate the astronaut's final speed after firing the thruster for 10s.
7.13	I can use **W=mg** to solve problems involving weight, mass and gravitational field strength, in different locations in the universe.
7.13.1	State the weight of each 1kg near the earth.
7.13.2	Calculate the weight on Earth of (i) a 30kg dog, (ii) a ½kg book, (iii) a 23g bag of crisps, (iv) a 2 tonne lorry? (1 tonne = 1000kg)
7.13.3	Calculate the weight of a 10 kg bag of potatoes on Earth.
7.13.4	Calculate the weight of a 250 g bag of sweets.
7.13.5	A girl has a weight of 450 N on Earth, calculate the mass of the girl.
7.13.6	Calculate the weight of a 10,000 kg spacecraft on a) Earth b) Mars c) Venus.
7.13.7	Calculate the weight of a 60 kg man on Jupiter.
7.13.8	State the planet's gravitational field strength most similar to our own.
7.13.9	An astronaut who weighs 700 N on Earth goes to a planet where he weighs 266 N. Calculate his mass and state which planet he was on.
7.13.10	An astronaut on Venus weighs 528 N. Calculate the weight of this astronaut on Earth.
7.13.11	(i) Draw a table showing the mass and weight of a 5.4 kg rock on Earth and Mars. (ii) If the rock was allowed to fall freely on Mars, state its initial acceleration close to the surface.
7.13.12	A lunar rover has a weight of 240N when on the moon Calculate is its mass and weight on the Earth.
7.13.13	The weight of a 20 kg mass on Europa, a moon of Jupiter, is 26.4 N. Calculate the gravitational field strength on Europa

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7.13.14	State what happens to the weight of a spacecraft as it moves further away from the Earth. *You must justify your answer*.
Cosmology	
8.1	I can correctly use the term light year
8.1.1	Describe the term light year.
8.1.2	State the symbol and the unit of a light year.
8.1.3	Betelgeuse is 350 light years away, explain what this means.
8.2	I can convert between light years and metres
8.2.1	The star Proxima Centauri is about 4.5 light years from the sun. Calculate this distance in metres.
8.2.2	The Milky Way (our galaxy) is 105,700 light years in diameter, calculate this distance in metres.
8.2.3	The Canis Major Dwarf Galaxy is only 2.36×10^{20} m from the Sun, determine this distance in light years.
8.2.4	Betelgeuse is approximately 640 light-years from the sun. Determine this distance in metres.
8.2.5	Within our solar system distances are often measured in astronomical units (AU).1 AU = $1{\cdot}50 \times 10^{11}$ m. Mars orbits the Sun at an average distance of 1·52 AU. Determine the average distance, in metres, at which Mars orbits the Sun.
8.3	I can give a basic description of the Big Bang theory of the origin of the Universe.
8.3.1	The term Big Bang has been use to described the origin of the Universe. Explain why this term appears appropriate.
8.3.2	Summarise the following video clip. https://www.youtube.com/watch?v=wNDGgL73ihY
8.4	I know the estimated age of the Universe.
8.4.1	State the approximate age of the Universe.
8.4.2	List and explain the evidence to support the age of the Universe?
8.5	I can describe how different parts of the electromagnetic spectrum are used to obtain information about astronomical objects.
8.5.1	List the parts of the electromagnetic spectrum in order of increasing wavelength
8.5.2	State a detector for each part of the electromagnetic spectrum
8.5.3	State what happens to the frequency of the radiation as the wavelength increases.

<table>
<tr><th>No.</th><th>Content</th></tr>
<tr><td>8.5.4</td><td>State how each part of the electromagnetic spectrum can be used to learn about space, complete the following table

<table>
<tr><th>Type of Radiation</th><th>Detector</th><th>Use</th></tr>
<tr><td>Radio</td><td>Radio Telescope</td><td>Used to study naturally occurring radio light from stars, galaxies, black holes, and other astronomical objects. They can also be used to transmit and reflect radio light off of planetary bodies in our solar system.</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
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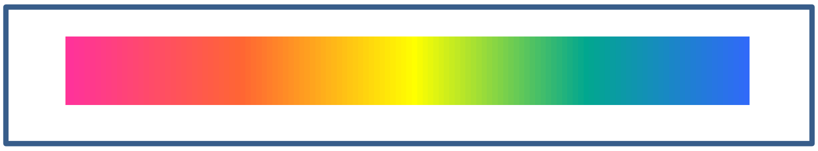
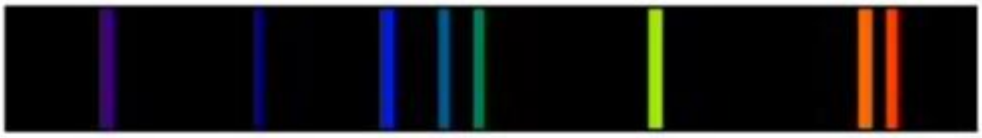
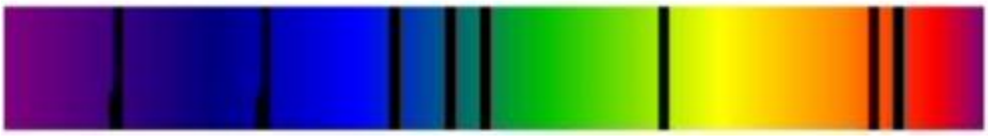
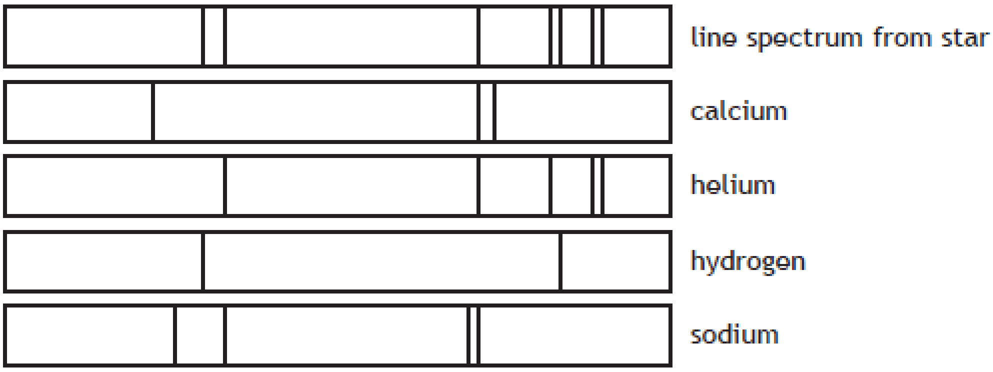
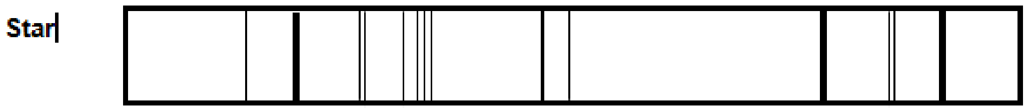
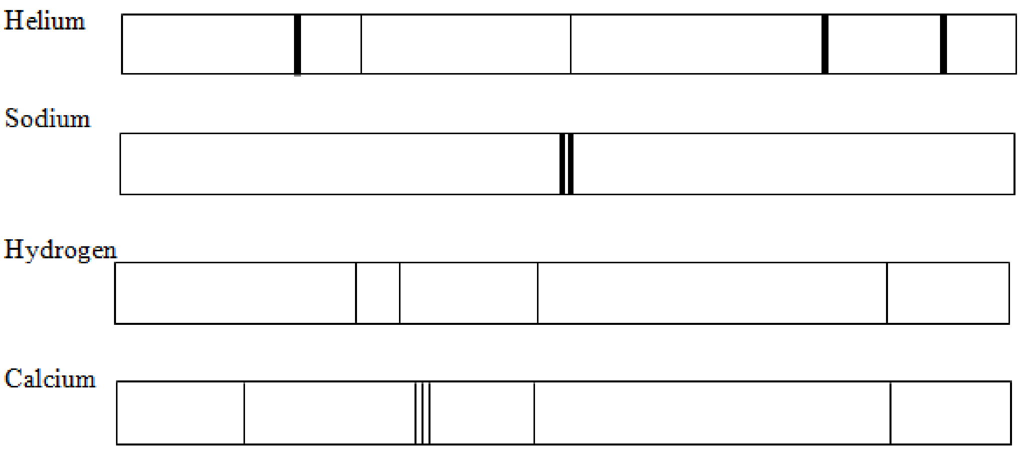
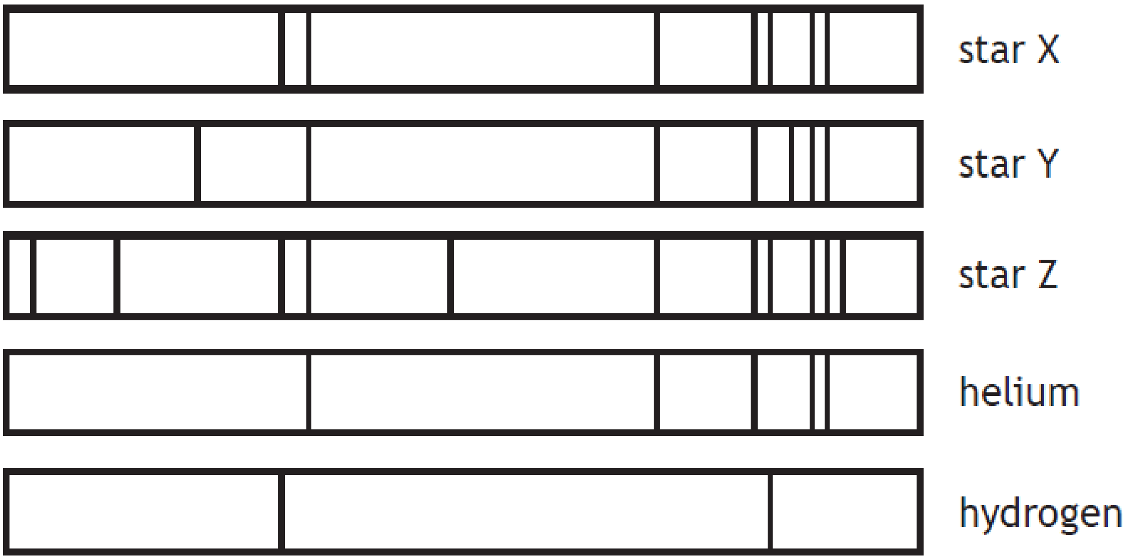
</td></tr>
<tr><td>8.6</td><td>I can identify continuous and line spectra.</td></tr>
<tr><td>8.6.1</td><td>State the type of spectrum shown in diagram below
</td></tr>
<tr><td>8.6.2</td><td>State the type of spectra shown in diagrams below.
(A) </td></tr>
<tr><td>8.6.3</td><td>(B) </td></tr>
<tr><td>8.6.4</td><td>(C) </td></tr>
<tr><td>8.6.5</td><td>(D) </td></tr>
<tr><td>8.7</td><td>I can use spectral data for known elements, to identify the elements present in stars.</td></tr>
</table>

No.	Content
8.7.1	Light from a star is split into a line spectrum of different colours. The line spectrum from the star is shown, along with the line spectra of the elements calcium, helium, hydrogen and sodium. State what elements are present in the star. 
8.7.2	 Known spectral data from a selection of elements is as follows:  A distant star produced spectral lines, as shown above, when viewed through a spectroscope. Identify the elements present in the star.

No.	Content
8.7.3	Light from stars can be split into line spectra of different colours. The line spectra from three stars, X, Y and Z, are shown, along with the line spectra of the elements helium and hydrogen.  State the stars that contain both hydrogen and helium.