Pearson Edexcel

Additional Assessment Materials Summer 2021

Pearson Edexcel GCSE in Physics (1PH0) Higher

Resource Set Topic E: Astronomy (Separate Physics Only)

Questions

(Public release version)

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Additional Assessment Materials, Summer 2021

General guidance to Additional Assessment Materials for use in 2021

Context

- Additional Assessment Materials are being produced for GCSE, AS and A levels (with the exception of Art and Design).
- The Additional Assessment Materials presented in this booklet are an **optional** part of the range of evidence teachers may use when deciding on a candidate's grade.
- 2021 Additional Assessment Materials have been drawn from previous examination materials, namely past papers.
- Additional Assessment Materials have come from past papers both published (those materials available publicly) and unpublished (those currently under padlock to our centres) presented in a different format to allow teachers to adapt them for use with candidate.

Purpose

- The purpose of this resource to provide qualification-specific sets/groups of questions covering the knowledge, skills and understanding relevant to this Pearson qualification.
- This document should be used in conjunction with the mapping guidance which will map content and/or skills covered within each set of questions.
- These materials are only intended to support the summer 2021 series.

4 (a) Which row of the table is correct for both force and velocity?

(1)

	force	velocity
☐ **A**	scalar	scalar
☐ **B**	scalar	vector
☐ **C**	vector	scalar
☒ **D**	vector	vector

(b) Figure 6 shows a satellite orbiting the Earth.

Figure 6

(i) State the name of the force that keeps the satellite in orbit around the Earth.

(1)

Gravity

(ii) Draw an arrow on Figure 6 to show the direction of the force acting on the satellite, that keeps the satellite in orbit around the Earth.

Label this arrow 'F'.

(1)

(c) Satellites are used to gather data about the origin of the Universe.

The Big Bang theory is a theory about the origin of the Universe.

Evidence for the Big Bang theory is provided by red-shift and CMB radiation.

(i) Describe what is meant by red-shift.

(2)

As a star moves away from Earth, the frequency of the light decreases causing the color to move towards red.

(ii) Explain how red-shift provides evidence for the Big Bang theory.

(2)

Red shift provides evidence that galaxies are moving away from each other. This expansion is usually found in an explosion which we refer as The Big Bang.

(iii) The Cosmic Background Explorer (COBE) satellite observed CMB radiation from 1989 to 1993.

State what the 'M' in CMB radiation stands for.

(1)

Microwave

(iv) State what is meant by 'cosmic background radiation'.

(1)

Radiation that comes from space.

(v) Explain how the presence of CMB radiation provides evidence for the Big Bang theory.

(2)

The initial explosion in the theory released radiation that is still radiating.

4

(c) (i) A long time ago, scientists believed that the Earth was at the centre of the Solar System.

Evidence has since proved that the Sun is at the centre of the Solar System.

State **one other** idea about the Solar System that **has** changed over time.

(1)

The fact that the solar system consist of 9 planets, which was changed after the discovery of Pluto as a dwarf planet.

(ii) Figure 4 shows data for some of the planets of the Solar System.

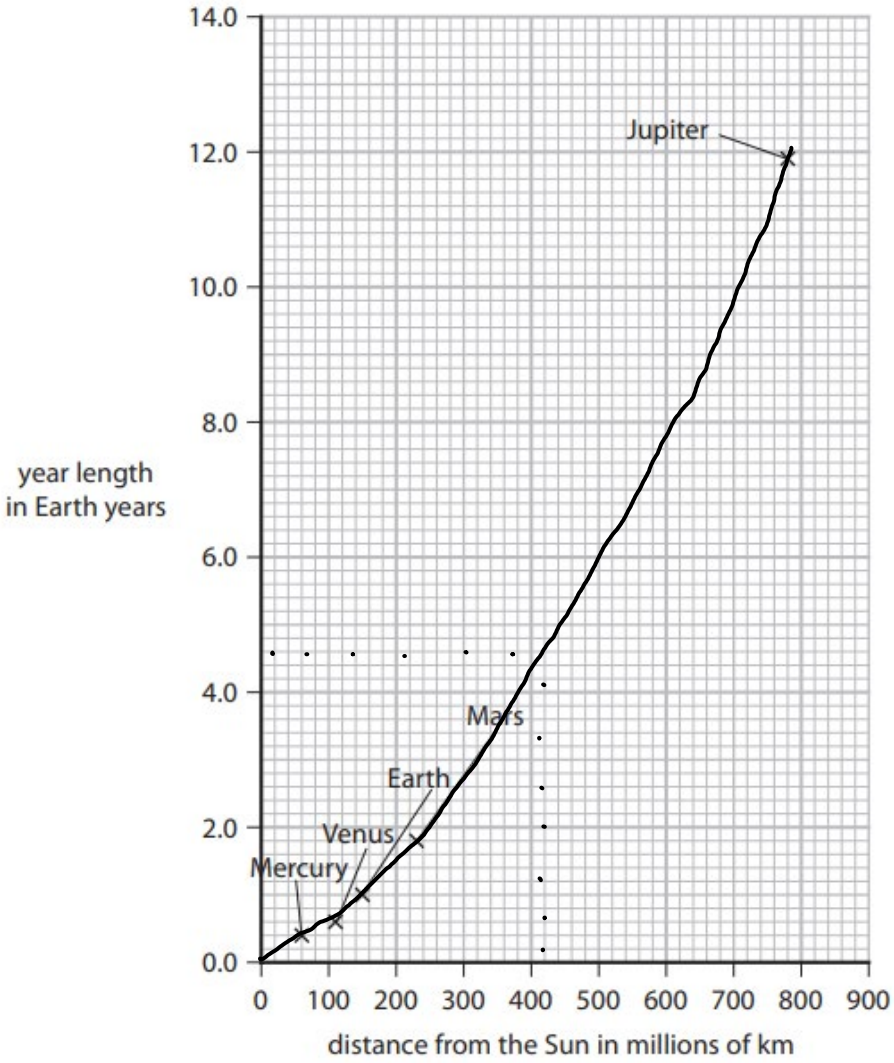

Figure 4

Ceres is an asteroid that orbits the Sun between Mars and Jupiter.
It takes Ceres 4.6 Earth years to make one orbit of the Sun.

Use the graph to estimate the distance of Ceres from the Sun.

Show your working.

(3)

distance of Ceres from the Sun = 410 millions of km

10 (a) Stars may originate as a nebula.

(i) Describe the process that then occurs to produce the conditions necessary for nuclear fusion in a new star.

(3)

The gas and dust in the nebula begin to collapse under gravitational attraction. As it collapse pressure from gravity causes the center to heat up creating a protostar. This core eventually becomes hot enough to sustain fusion, creating a star.

(ii) The energy, E, released in nuclear fusion is equivalent to loss in mass, m, according to the equation.

$$E = mc^2$$

where c is the velocity of light.

$c = 3.00 \times 10^8$ m/s

In 1 second, the energy radiated by the Sun is 3.86×10^{26} J.

Calculate the loss in mass of the Sun in 1 second.

(2)

$3.86 \times 10^{26} = m \times (3 \times 10^8)^2$

$m = \frac{3.86 \times 10^{26}}{(3 \times 10^6)^2}$

$= 4.289 \times 10^9$

$\approx 4.3 \times 10^9$

loss in mass = 4.3×10^9 kg

*(b) The Big Bang theory gives an explanation for the origin of the Universe.

Explain how evidence supports the ideas that

- the Universe is expanding
- the Universe began at a single point.

(6)

The red shift provide evidence of the expansion as galaxies are seen to be moving away from earth and moving faster as the separation increases. Another evidence is the existence of CMBR to prove that microwave background radiation in space is left over from the explosion.

(c) A star has evolved to become a neutron star.

The mass, M, of the neutron star, of radius R, is given by

$$M = \frac{4 \times \pi \times D \times R^3}{3}$$ where D is a constant

$M = 4 \times 10^{30}$ kg

$D = 6 \times 10^{17}$ kg/m^3

Use the equation to calculate the value for R.

(2)

$$4 \times 10^{30} = \frac{4 \times \pi \times 6 \times 10^{17} \times R^3}{3}$$

$$R = \left[\frac{(4 \times 10^{30}) \times 3}{4 \times \pi \times (6 \times 10^{17})} \right]^{1/3}$$

$= 11675 \approx 12000$ R = 12000 m

4 (a) The Sun has a mass of 2.0×10^{30} kg.
A white dwarf has a mass of 3.4×10^{29} kg.

Calculate the value of

$$\frac{\text{mass of this white dwarf}}{\text{mass of the Sun}}$$

(2)

$$\frac{3.4 \times 10^{29}}{2 \times 10^{30}}$$

value = 0.17

(b) Figure 4 is a diagram giving some information about main sequence stars.
Luminosity is a measure of how bright something is.
An increase in luminosity means an increase in brightness.

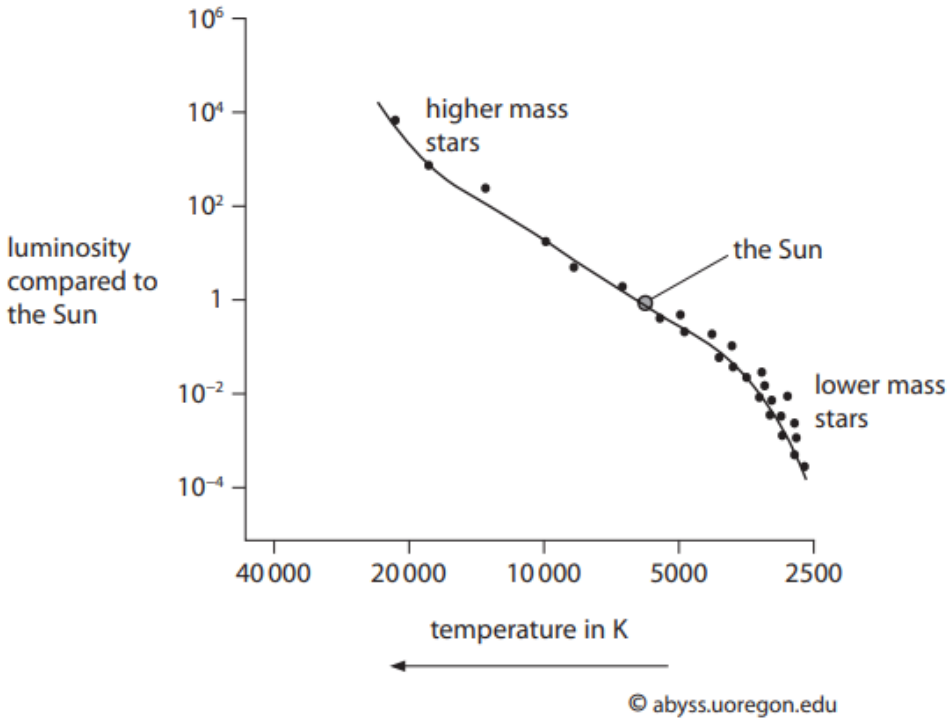

Figure 4

(i) Estimate the temperature of the Sun.

(1)

temperature of the Sun = 7000 K

(ii) State how the brightness of a main sequence star changes with its temperature.

(1)

As temperature increases the luminosity increases

(iii) State how the brightness of a main sequence star changes with its mass.

(1)

As the mass increases, brightness increases

(c) Nuclear fusion provides the energy source for stars including the Sun.

Describe what happens during nuclear fusion.

(3)

Two or more nuclei fuse together under high temperatures and pressure to form a larger nuclei.

(d) A nebula may evolve into a main sequence star, such as the Sun.

Explain how a nebula may evolve into a main sequence star.

(3)

The gas and dust in the nebula begin to collapse under gravitational attraction. As it collapse pressure from gravity causes the center to heat up creating a protostar. This core eventually becomes hot enough to sustain fusion, creating a star.

TOTAL FOR PAPER IS 39 MARKS