FOUNDATION

P8F Space Physics: Foundation Tier Practice

Total Marks

AQA 8463 · Calculator allowed · about 90 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Name two different types of object found in our Solar System (for example, 'planet' is one).

(a) Give two different types of object found in our Solar System. **(2)**

(Total for Question 1 is 2 marks)

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2 State what is meant by the term 'galaxy'.

(a) State the meaning of 'galaxy'. **(1)**

(Total for Question 2 is 1 mark)

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3 Here are four objects: Earth, Sun, Moon, Jupiter. Put the objects in order of size from smallest to largest.

(a) Order these from smallest to largest: Earth, Sun, Moon, Jupiter. **(1)**

(Total for Question 3 is 1 mark)

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4 Explain the difference between a planet's rotation and its orbit.

(a) Explain how rotation is different from orbit. **(2)**

(Total for Question 4 is 2 marks)

5 A small asteroid takes 5.0 days to complete one rotation. Convert this rotation period into seconds. Show your working.

(a) Convert 5.0 days into seconds. 1 day = 24 hours, 1 hour = 3600 s. **(2)**

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(Total for Question 5 is 2 marks)

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6 State why gravity is important for keeping a planet in orbit around a star.

(a) State why gravity keeps a planet in orbit. **(1)**

(Total for Question 6 is 1 mark)

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7 A small satellite travels 40 000 km along its orbit in 90 minutes. Calculate the average speed of the satellite in km/s. Show your working.

(a) Calculate average speed = distance / time. Distance = 40000 km, time = 90 minutes. **(2)**

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(Total for Question 7 is 2 marks)

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8 State what a light-year measures.

(a) State what a light-year is a measure of. **(1)**

(Total for Question 8 is 1 mark)

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9 Light travels at 300000 km/s. Calculate how far light travels in one day. Give your answer in kilometres and show your working. 1 day = 86400 s.

(a) Calculate distance = speed x time using speed 300000 km/s and time 86400 s. **(2)**

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(Total for Question 9 is 2 marks)

10 State one scientific use of a telescope.

(a) State one use of a telescope. **(1)**

(Total for Question 10 is 1 mark)

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11 Explain in simple terms what astronomers mean by 'redshift'.

(a) Explain what redshift means. **(1)**

(Total for Question 11 is 1 mark)

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12 A star has brightness 100 arbitrary units at a distance of 2 parsecs. Using the inverse-square law, calculate its brightness at 4 parsecs. Show your working.

(a) Brightness is proportional to $1/d^2$. If brightness = 100 at d = 2 pc, find brightness at d = 4 pc. **(2)**

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(Total for Question 12 is 2 marks)

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13 State how the colour of a star relates to its surface temperature.

(a) State the relationship between star colour and temperature. **(1)**

(Total for Question 13 is 1 mark)

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14 Give three brief statements that describe the main stages in the life cycle of a sun-like star.

(a) Give three statements describing the main stages of a sun-like star. **(3)**

(Total for Question 14 is 3 marks)

15 You are asked to model the relative sizes and distances of the Sun and planets using a classroom strip of paper 10 m long. Suggest a simple method that would represent the relative distances from the Sun to Earth and to Jupiter on the paper, and state one variable you would control to make the model fair.

(a) Suggest a method to place Earth and Jupiter on a 10 m strip to represent their relative distances, and name one control variable. **(3)**

(Total for Question 15 is 3 marks)

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16 Explain how two pieces of observational evidence support the Big Bang theory of the origin of the Universe.

Explain how two pieces of observational evidence support the Big Bang theory. You should include relevant observations and say how each observation supports the idea of an expanding universe that began in a hot, dense state.

(Total for Question 16 is 6 marks)

Mark scheme · P8F Space Physics: Foundation Tier Practice

Question 1

- (a) **B1** one correct type named, e.g. planet, moon, comet, asteroid, dwarf planet, meteoroid, B1
- (a) **B1** a different correct type named, oe
- **(a) Answer: Any two of: planet; moon; comet; asteroid; dwarf planet; meteoroid.**

Question 2

- (a) **B1** a very large group of stars, gas and dust held together by gravity (for example, the Milky Way), oe
- **(a) Answer: A very large group of stars, gas and dust held together by gravity.**

Question 3

- (a) **B1** Moon, Earth, Jupiter, Sun (from smallest to largest) cao
- **(a) Answer: Moon, Earth, Jupiter, Sun.**

Question 4

- (a) **B1** rotation is a spin of the planet about its own axis, oe
- (a) **B1** orbit is the movement of the planet around another object, e.g. around a star, oe
- **(a) Answer: Rotation is the spin of a planet about its own axis; orbit is the movement of the planet around another body such as a star.**

Question 5

- (a) **M1** converts days to seconds: 5.0 x 24 x 3600 shown
- (a) **A1** 432000 s cao
- **(a) Answer: 432000 s**

Question 6

- (a) **B1** gravity provides a force pulling the planet towards the star, causing the planet to follow a curved path or orbit, oe
- **(a) Answer: Because gravity pulls the planet towards the star, causing it to move in a curved path around the star.**

Question 7

- (a) **M1** substitutes with time converted to seconds: 40000 km / (90 x 60 s) or equivalent
- (a) **A1** 7.41 km/s (3 s.f.) cao
- **(a) Answer: 7.41 km/s**

Question 8

- (a) **B1** a unit of distance equal to the distance light travels in one year, cao
- **(a) Answer: A light-year is the distance that light travels in one year.**

Question 9

- (a) **M1** substitutes: distance = 300000 x 86400
- (a) **A1** 25920000000 km or 2.592×10^{10} km cao
- **(a) Answer: 25920000000 km**

Question 10

- (a) **B1** any one use, e.g. observing distant stars and galaxies, measuring brightness of objects, detecting planets, analysing spectra, oe
- **(a) Answer: For observing distant stars and galaxies (or detecting planets, measuring brightness or analysing spectra).**

Question 11

- (a) **B1** light from an object is shifted to longer wavelengths (towards red) usually because the object is moving away, oe
- **(a) Answer: Redshift is when light from an object is shifted to longer wavelengths (towards red), usually because the object is moving away.**

Question 12

- (a) **M1** uses inverse square: brightness new = 100 x $(2/4)^2$ or shows 100 x $(1/2)^2$
- (a) **A1** 25 units cao
- **(a) Answer: 25 units**

Question 13

- (a) **B1** hotter stars appear bluer and cooler stars appear redder, oe
- **(a) Answer: Hotter stars appear bluer and cooler stars appear redder.**

Question 14

- (a) **B1** formation from a cloud of gas and dust (protostar) or similar phrasing
- (a) **B1** main sequence where hydrogen fusion occurs in the core, oe
- (a) **B1** red giant phase followed by shedding outer layers and forming a white dwarf (with planetary nebula), oe
- **(a) Answer: Any three of: formation from a cloud of gas and dust (protostar); main sequence where hydrogen fuses in the core; red giant phase; sheds outer layers and becomes a white dwarf with a planetary nebula.**

Question 15

- (a) **B1** method: scale real distances down to the 10 m strip and mark positions from one end as the Sun, oe
- (a) **B1** example calculation or statement of scale, e.g. choose scale so Earth is at 11 cm and Jupiter at 52 cm (or another plausible scaled values) showing calculation or clear scaling idea, oe
- (a) **B1** control variable: keep the same scale for all planets or control choice of reference point on the paper, oe
- **(a) Answer: Method: choose a scale to reduce real distances to fit 10 m and mark the Sun at 0 m then mark Earth and Jupiter at their scaled distances. Control variable: use the same scale for all planets (keep scale fixed).**

Question 16

- **Level 3** (5-6): A clear, detailed explanation linking two observations to the Big Bang theory. Each observation is described accurately and the answer explains how it supports expansion from a hot, dense state.
- **Level 2** (3-4): A partially developed answer. At least one observation is described and linked to expansion or a hot dense early state, but explanations lack detail or one observation is not fully linked.
- **Level 1** (1-2): A simple answer with brief statements of observations or claims with little explanation of how they support the Big Bang theory.
- **Indicative content:**
  - Observation 1: Redshift of galaxies - light from distant galaxies shifted to longer wavelengths; this shows galaxies are moving away, implying the universe is expanding.
  - How it supports Big Bang: expansion means in the past galaxies were closer together, consistent with origin from a dense state.
  - Observation 2: Cosmic microwave background radiation (CMB) - a background of microwave radiation detected in all directions with a temperature of about 2.7 K.
  - How it supports Big Bang: CMB is interpreted as cooled radiation left over from an early hot dense phase, so it is direct evidence of an earlier hotter state.
  - Additional points: observation of element abundances (e.g. hydrogen and helium ratios) is consistent with predictions from early hot conditions and supports the theory.
  - A balanced answer may note limitations or that alternative explanations must also match these observations.