6. Space physics

6.1 Earth and the Solar System

Paper 3 and 4

Question Paper

Paper 3

Questions are applicable for both core and extended candidates

1 Fig. 11.1 represents the planets in the Solar System.

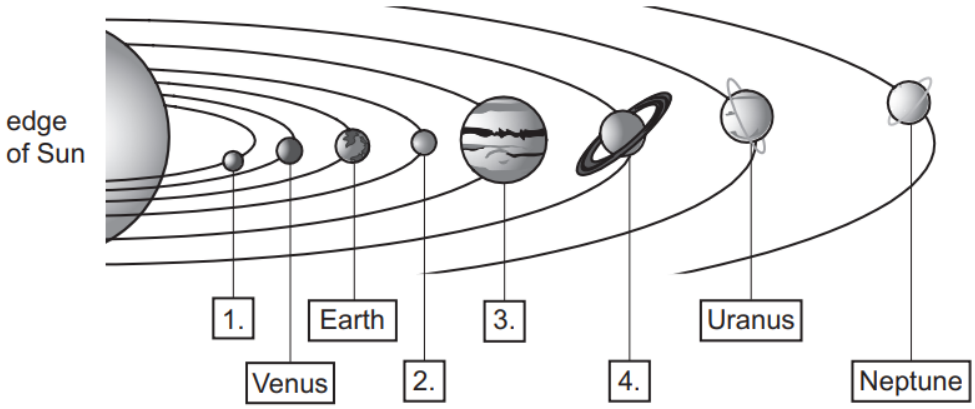

Fig. 11.1 (not to scale)

(a) In Fig. 11.1, there are four labels without the name of the planet.

For each label, state the name of the planet.

1. ..... 2. .....

3. ..... 4. .....

[2]

2 **(a)** Fig. 11.1 represents part of the Solar System.

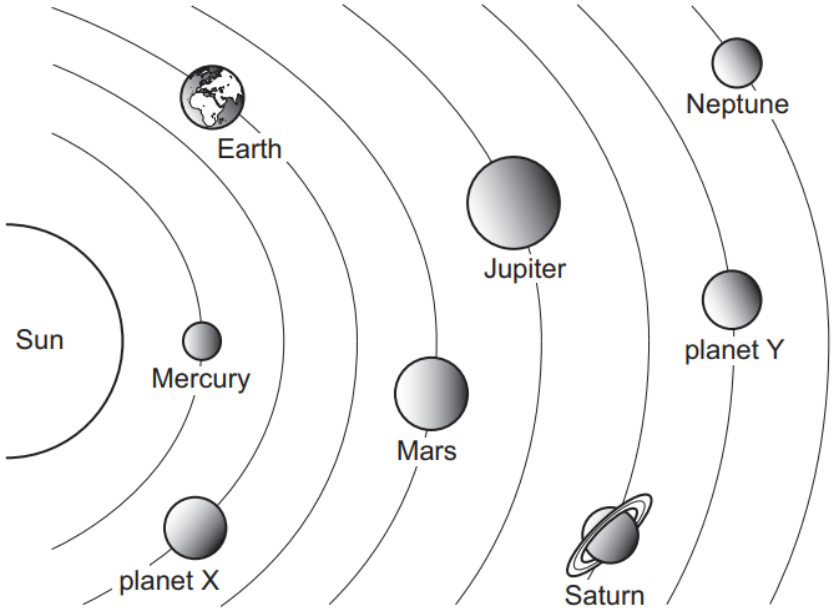

Fig. 11.1 (not to scale)

(i) State the name of planet X and the name of planet Y.

planet X .....

planet Y .....

[2]

(ii) Mercury is nearer to the Sun than Jupiter is.
State **two** other ways in which Mercury is different from Jupiter.

1 .....

2 .....

[2]

(iii) Complete the sentences about the Solar System.

The accretion model states that the Solar System was formed from clouds of dust and

..... .

The material of the Solar System was pulled together by ..... .

The galaxy that includes the Solar System is called ..... .

[3]

(b) Complete the following statements by adding the missing units.

(i) The Earth orbits the Sun in approximately 365 ..... . [1]

(ii) The Moon orbits the Earth in approximately one ..... . [1]

(iii) The diameter of the Milky Way is approximately 100 000 ..... . [1]

[Total: 10]

3 Table 11.1 shows some information about two of the planets in the Solar System.

Table 11.1

name of planet	mass of planet /kg	distance from the Sun /km	time for one rotation on its axis /hours
Venus	4.87×10^{24}	108.2×10^{6}	5832
Earth	5.97×10^{24}	149.6×10^{6}	24

(a) (i) Venus is a similar size to the Earth.

State why the gravitational field strength at the surface of the Earth is greater than the gravitational field strength at the surface of Venus.

..... [1]

(ii) Calculate the time, in Earth days, for **one** day on Venus.

time = ... Earth days [3]

(iii) Calculate the time taken for light to travel from the Sun to Venus. The speed of light is 3.0×10^{8} m/s.

time taken = ... s [4]

(b) The star nearest to the Sun is about 4.25 light-years from the Sun.

Explain what is meant by one light-year.

.....

..... [2]

[Total: 10]

4 Fig. 11.1 represents the Sun and part of the Solar System.

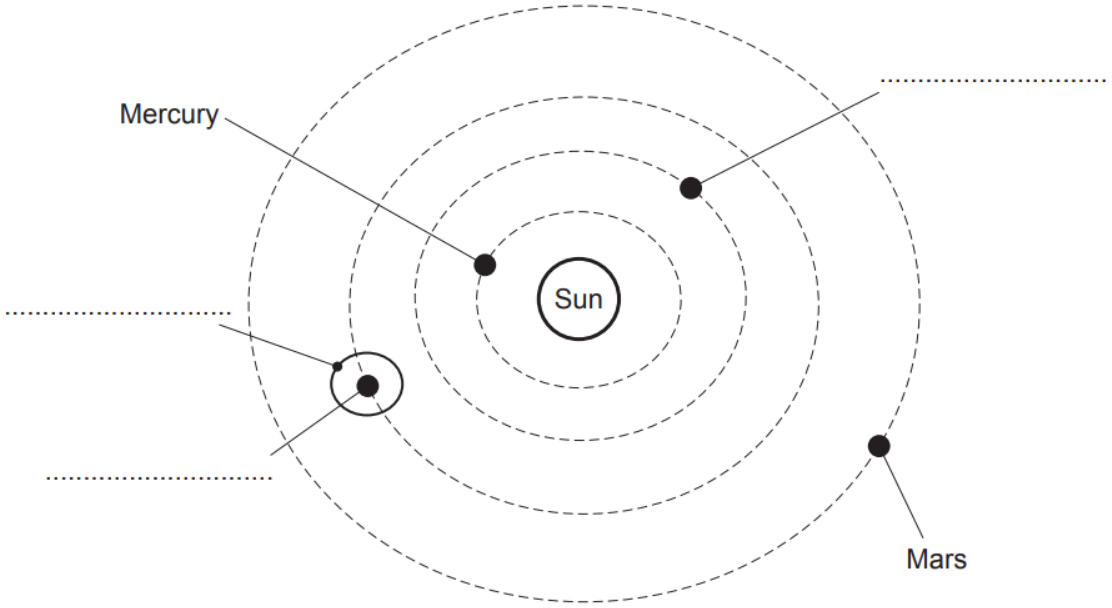

Fig. 11.1 (not to scale)

(a) Complete the labels on Fig. 11.1 by writing on the dotted lines. [3]

(b) Complete the sentences about the Sun.

The Sun consists mostly of the elements ..... and

..... .

Most of the Sun's energy is radiated in the infrared, ...

and ..... regions of the electromagnetic spectrum. [4]

(c) Give an estimate for the diameter of the Milky Way galaxy.

diameter = ... light-years [1]

[Total: 8]

5 There are eight planets in our Solar System.

Table 12.1 shows the names of some of the planets in order of distance from the Sun.

Table 12.1

Mercury				Jupiter			Neptune
increasing distance from the Sun →							

(a) Complete Table 12.1 by writing the names of the other planets in order of increasing distance from the Sun. [2]

(b) The planets in Table 12.1 orbit the Sun.

State the names of **two** other types of natural object that orbit the Sun.

1 .....

2 .....

[2]

(c) Complete the sentences to describe Mercury and Jupiter. Use words from the list.

large **rocky** **gaseous** **small** **liquid**

Mercury is ..... and .....

Jupiter is ..... and .....

[2]

[Total: 6]

6 **(a)** Fig. 12.1 represents the Earth and the Sun at one point in the Earth's orbit of the Sun.

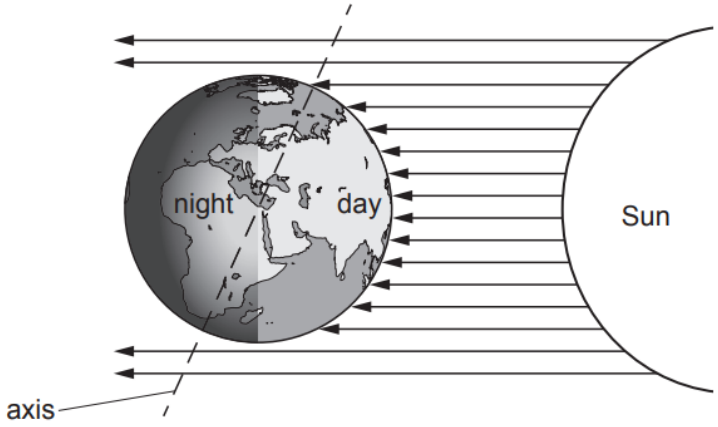

Fig. 12.1 (not to scale)

Explain the apparent daily motion of the Sun across the sky.

.....

.....

..... [2]

(b) List the four planets closest to the Sun in order of their distance from the Sun. One is done for you.

1 ..... 2 ..... 3 Earth ..... 4 ..... [2]

(c) The Sun mostly consists of two elements.

State the **two** elements.

1 .....

2 .....

[2]

(d) The Sun is a star in a galaxy.

State the name of the galaxy.

..... [1]

[Total: 7]

7 Fig. 11.1 shows the Sun and the four innermost planets, A, B, C, and D, of the Solar System.

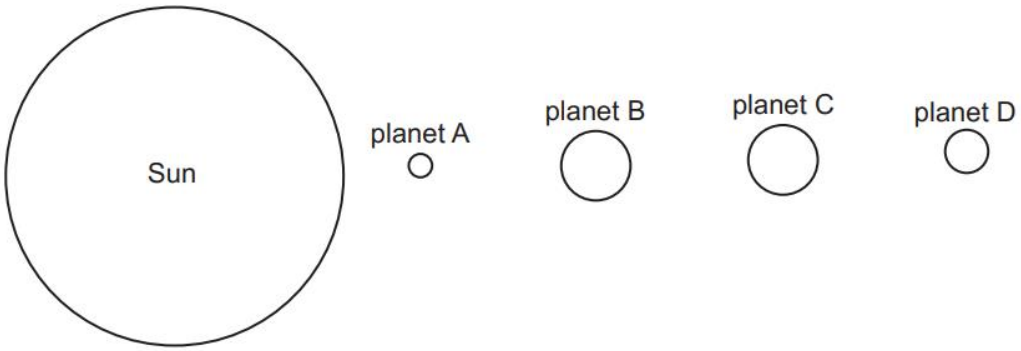

Fig. 11.1 (not to scale)

(a) In Table 11.1, write the names of the innermost planets. One is done for you.

Table 11.1

planet	name of planet
A	
B	Venus
C	
D	

[2]

Paper 4

Questions are applicable for both core and extended candidates unless indicated in the question

8 **(a)** **(i)** State the name of **one** planet that has an orbit further away from the Sun than Venus.

..... [1]

(ii) State the name of **one** planet that has an orbit closer to the Sun than Venus.

..... [1]

(b) Venus has an average radius of orbit of 1.1×10^{11} m and an orbital period of 220 Earth days. Calculate the average orbital speed of Venus. Give your answer in m/s. **(extended only)**

average orbital speed = ... m/s [3]

(c) State the relationship between the orbital speeds of the planets and their distances from the Sun. **(extended only)**

.....

..... [1]

(d) Comets are balls of ice and dust. Some comets orbit the Sun. **(extended only)**

State how the speed of a comet changes as it orbits the Sun.
Explain your answer using ideas about the conservation of energy.

You may include a labelled diagram in your answer.

.....

.....

..... [3]

[Total: 9]

9 **(a)** The Solar System includes the Sun and planets.

State **two** other types of natural object that orbit the Sun.

1 .....

2 .....

[2]

(b) State the shape of the orbits of the planets. **(extended only)**

..... [1]

(c) Fig. 10.1 shows the orbit of an object around the Sun. At point A, the object is closest to the Sun. At point B, the object is furthest away from the Sun. **(extended only)**

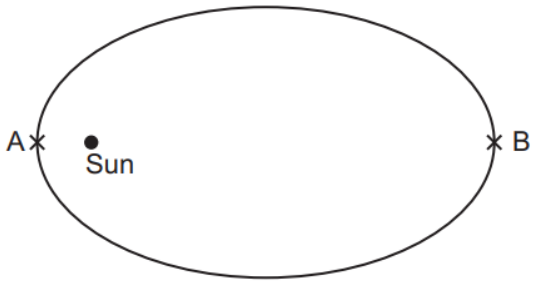

Fig. 10.1

State and explain the energy transfer as the object travels from point A to point B.

statement .....

.....

explanation .....

.....

[2]

(d) Jupiter is 7.8×10^{11} m from the Sun. The speed of light in a vacuum is 3.0×10^{8} m/s.

Calculate the time taken for light from the Sun to reach Jupiter.

time = ... [2]

[Total: 7]

10 Table 9.1 gives information about three planets in the Solar System.

Table 9.1

planet	mass / 10^{24} kg	average distance from Sun / 10^{6} km	orbital period / days	gravitational field strength at surface / N/kg
Earth	5.97	149.6	365.2	9.8
Jupiter	1898	778.6	4331	23.1
X	4.87	108.2	224.7	8.9

(a) State the name of planet X. **(extended only)**

..... [1]

(b) Describe the relationship shown in Table 9.1 between the mass of a planet and the gravitational field strength at its surface. **(extended only)**

.....

..... [1]

(c) Explain why 'distance from Sun' in Table 9.1 is an average value. **(extended only)**

.....

..... [1]

(d) Show that the average orbital speed of the Earth is approximately 30 km/s. **(extended only)**

[3]

[Total: 6]

11 Pluto is a dwarf planet. Fig. 10.1 shows the direction of motion of Pluto as it follows its elliptical orbit around the Sun.

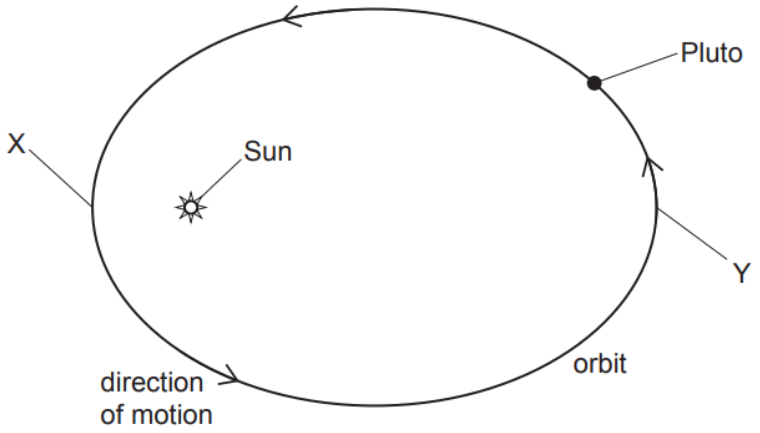

Fig. 10.1 (not to scale)

(a) Point X is the point in the orbit closest to the Sun and point Y is the point furthest away.

The orbital speed of Pluto varies as it orbits the Sun.

(i) Describe how the speed of Pluto varies as it moves from X to Y and then back to X. **(extended only)**

.....

..... [1]

(ii) Explain, in terms of energy transfers, why the speed of Pluto varies in this way. **(extended only)**

.....

.....

.....

..... [3]

(b) The average temperature on the surface of Pluto is 43 K.

(i) Convert this temperature to a value in degrees Celsius (°C).

temperature = ... °C [1]

(ii) Pluto has a white surface, as shown in Fig. 10.2. As Pluto rotates, the white surface alternately faces towards and away from the Sun.

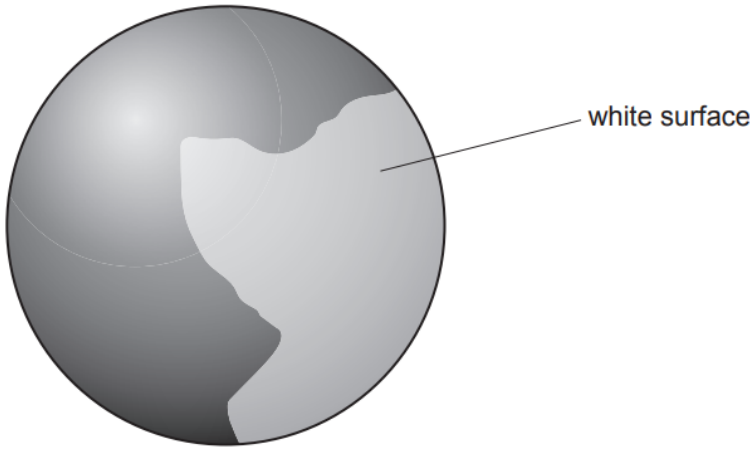

Fig. 10.2

Explain how this affects the temperature of Pluto as it rotates on its own axis.

.....

.....

.....

..... [2]

[Total: 7]