Space Physics – 2023 IGCSE Physics 0625

1. Nov/2023/Paper_ 0625/11/No.38

Which planet orbits the Sun between Mars and Saturn?

A Earth

B Jupiter

C Mercury

D Neptune

2. Nov/2023/Paper_ 0625/11/No.39

Which statement about the Sun is correct?

A The Sun is a dwarf star consisting mostly of hydrogen and oxygen.

B The Sun is a giant star consisting mostly of helium and carbon dioxide.

C The Sun is a medium-sized star consisting mostly of hydrogen and helium.

D The Sun is a medium-sized star consisting mostly of nitrogen and oxygen.

3. Nov/2023/Paper_ 0625/11/No.40

Which quantity does a light-year measure?

A an angle

B a distance

C a speed

D a time

4. Nov/2023/Paper_ 0625/12/No.38

Approximately how long does the Moon take to orbit the Earth?

A 1 day

B 7 days

C 28 days

D 365 days

5. Nov/2023/Paper_ 0625/12/No.39

The Sun transfers energy to the Earth through electromagnetic radiation.

What are two of the parts of the electromagnetic spectrum to which most of the energy belongs?

A gamma rays and X-rays

B infrared radiation and visible light

C microwaves and visible light

D radio waves and microwaves

6. Nov/2023/Paper_ 0625/12/No.40

What provides evidence that the Universe is expanding?

A Stars in galaxies outside the Milky Way are all red.

B The Andromeda galaxy is moving toward the Milky Way.

C Light from distant galaxies is shifted to longer wavelengths.

D The Universe is 14 billion years old.

7. Nov/2023/Paper_ 0625/13/No.38

Which time period is approximately equal to 24 hours?

A the time for the Earth to complete one rotation on its axis

B the time for the Earth to orbit the Sun

C the time for the Moon to orbit the Earth

D the time for the Sun to orbit the Earth

8. Nov/2023/Paper_ 0625/13/No.39

The nearest star to the Sun is about four light-years away from the Earth.

A student makes three statements about the star.

1 Light from the star takes about four years to reach the Earth.

2 Light from the Sun takes about four years to travel to the star and back to the Earth.

3 The star is outside our galaxy.

Which statements are correct?

A 1, 2 and 3 **B** 1 and 3 only **C** 1 only **D** 2 and 3 only

9. Nov/2023/Paper_ 0625/13/No.40

The table shows some elements and some regions of the electromagnetic spectrum.

Which row shows one of the most common elements in the Sun and one of the regions in which the Sun radiates most of its energy?

	element	region
A	iron	gamma
B	iron	infrared
C	hydrogen	gamma
D	hydrogen	infrared

10. Nov/2023/Paper_ 0625/21/No.38

It is summer in the northern hemisphere of the Earth in June.

Which statement explains why?

A The Earth is closer to the Sun in June.

B The Earth spins on its axis in the opposite direction to that in which it rotates around the Sun.

C The Moon is full in June.

D The north pole of the axis of the Earth's rotation is tilted towards the Sun in June.

11. Nov/2023/Paper_ 0625/21/No.39

Which statement about the Sun is correct?

A The Sun is a dwarf star consisting mostly of hydrogen and oxygen.

B The Sun is a giant star consisting mostly of helium and carbon dioxide.

C The Sun is a medium-sized star consisting mostly of hydrogen and helium.

D The Sun is a medium-sized star consisting mostly of nitrogen and oxygen.

12. Nov/2023/Paper_ 0625/21/No.40

The table lists some information about some stars.

Which star will eventually explode as a supernova?

	name of star	type of star	temperature / °C
A	Aldebaran	red giant	3 700
B	Betelgeuse	red supergiant	3 300
C	Geminga	neutron star	520 000
D	Sirius B	white dwarf	25 000

13. Nov/2023/Paper_ 0625/22/No.38

The time taken for the Earth to orbit the Sun is approximately 365 days.

The average radius of the Earth's orbit around the Sun is 1.5×10^8 km.

What is the average orbital speed of the Earth?

A 30 m / s

B 4.8×10^3 m / s

C 3.0×10^4 m / s

D 4.1×10^{10} m / s

14. Nov/2023/Paper_ 0625/22/No.39

The Sun transfers energy to the Earth through electromagnetic radiation.

What are two of the parts of the electromagnetic spectrum to which most of the energy belongs?

A gamma rays and X-rays

B infrared radiation and visible light

C microwaves and visible light

D radio waves and microwaves

15. Nov/2023/Paper_ 0625/22/No.40

How does the Sun produce its energy?

A by the fission of helium

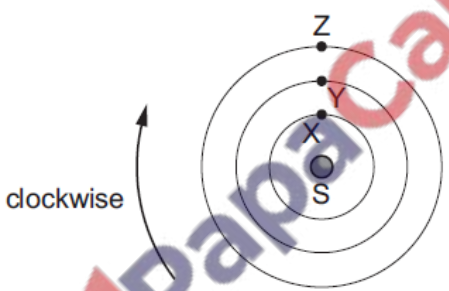
B by the fission of hydrogen

C by the fusion of helium

D by the fusion of hydrogen

16. Nov/2023/Paper_ 0625/23/No.38

The diagram shows a star S and the initial arrangement of three planets, X, Y and Z.



NOT TO SCALE

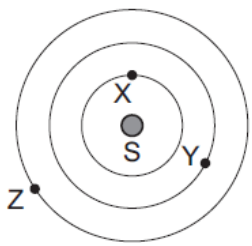
Each planet orbits clockwise in a circle about S.

The time for one orbit of Y is three times the time taken for one orbit of X.

The time for one orbit of Z is twice the time taken for one orbit of Y.

Starting from the initial arrangement, which diagram shows the positions of the planets after X has made one complete orbit?

A



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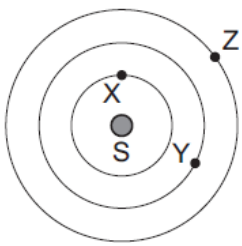
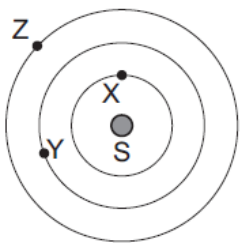
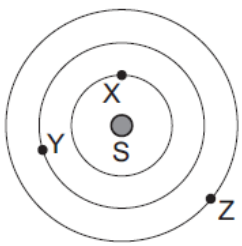


C



D



17. Nov/2023/Paper_ 0625/23/No.39

The nearest star to the Sun is about four light-years away from the Earth.

A student makes three statements about the star.

1 Light from the star takes about four years to reach the Earth.

2 Light from the Sun takes about four years to travel to the star and back to the Earth.

3 The star is outside our galaxy.

Which statements are correct?

A 1, 2 and 3 **B** 1 and 3 only **C** 1 only **D** 2 and 3 only

18. Nov/2023/Paper_ 0625/23/No.40

A planet orbits the Sun with orbital period T. The average radius of the orbit is r.

What is the average orbital speed of the planet?

A $2\pi rT$ **B** $\frac{2\pi r}{T}$ **C** $\frac{T}{2\pi r}$ **D** $\frac{\pi r}{2T}$

19. Nov/2023/Paper_ 0625/31/No.11

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

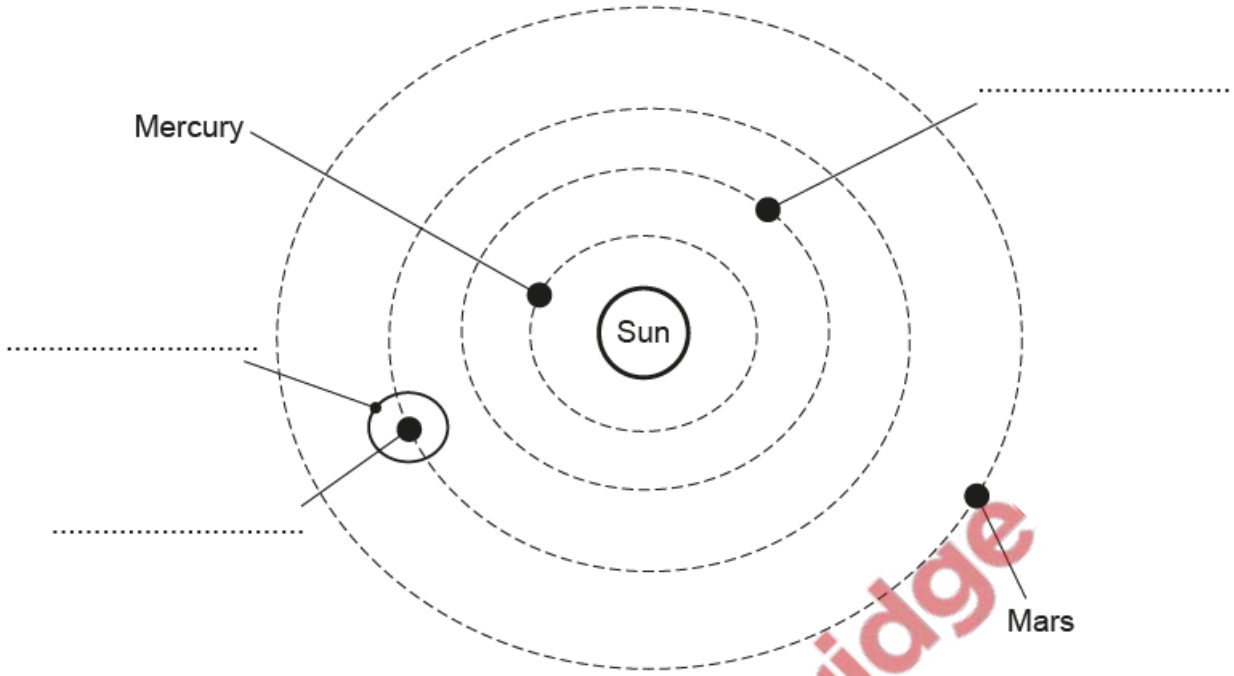


Fig. 11.1 (not to scale)

(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]

20. Nov/2023/Paper_ 0625/32/No.12

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]

21. Nov/2023/Paper_ 0625/33/No.11

Fig. 11.1 represents the Earth in orbit around the Sun.

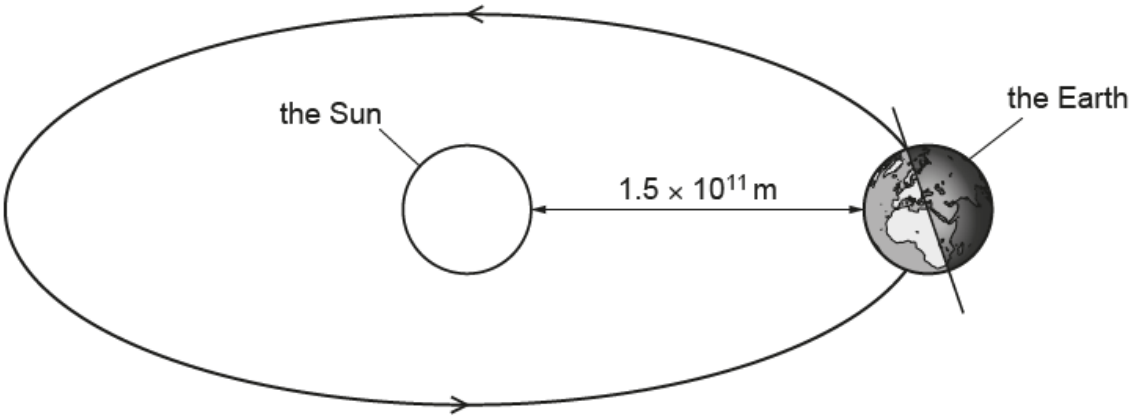


Fig. 11.1 (not to scale)

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

..... [1]

(ii) State the time taken by the Earth to complete **one** orbit of the Sun. Include the unit.

time for **one** orbit = ... [1]

(iii) State the time taken by the Earth to rotate **once** on its axis. Include the unit.

time for **one** rotation = ... [1]

(iv) The Sun consists mainly of two gases. State the names of the **two** gases.

..... and ..... [2]

(b) **(i)** Most of the radiation from the Sun consists of visible light and two other regions of the electromagnetic spectrum.

State the name of **one** of the other two regions.

..... [1]

(ii) The speed of visible light is 3.0×10^8 m/s.

Calculate the time taken for visible light to travel from the Sun to the Earth when the Earth is in the position shown in Fig. 11.1.

time taken = ... s [3]

[Total: 9]

22. Nov/2023/Paper_ 0625/41/No.10

The Milky Way is one of many billions of galaxies. Each galaxy contains many billions of stable stars.

(a) Stable stars transfer energy into space by emitting electromagnetic radiation from their surfaces.

Describe what happens in the core of a stable star to release energy that is eventually transferred into space.

.....

.....

.....

..... [3]

(b) On the Earth, light from a distant galaxy is observed and analysed by astronomers. This information is used to determine the speed at which the galaxy is moving away from the Earth.

(i) Describe how the observed light is different from when it was emitted.

.....

.....

..... [2]

(ii) State the quantity that astronomers use to determine the speed at which the galaxy is moving away.

..... [1]

(c) The Hubble constant H_0 is equal to 2.2×10^{-18} per second.

(i) Calculate the distance from the Earth of a galaxy that is moving away at a speed of 1.3×10^7 m/s.

distance = ... [2]

(ii) Calculate an estimate for the age of the Universe. Give your answer in years.

age of the Universe = ... years [2]

[Total: 10]

23. Nov/2023/Paper_ 0625/42/No.9

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.

..... [1]

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

.....

..... [1]

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

.....

..... [1]

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

[3]

[Total: 6]

24. Nov/2023/Paper_ 0625/42/No.10

Complete the sentences about the life cycle of stars.

(a) Protostars are formed from .....

..... [1]

(b) A protostar becomes a stable star when .....

.....

is balanced by .....

.....

[2]

(c) The initial fuel used to power nuclear reactions in stars is ..... [1]

(d) Stars that are approximately the same size as the Sun become red giant stars which then form a .....

with a white dwarf star at its centre. [1]

[Total: 5]

(a) **(i)** **1.** State what is represented in space physics by the symbol H_0.

..... [1]

2. Write down the equation that defines H_0 in terms of the speed that a far galaxy is moving away from the Earth and its distance from the Earth.

..... [1]

(ii) The numerical value of H_0 is 2.2×10^{-18}. State the unit of H_0.

..... [1]

(iii) Use this value of H_0 to determine an estimate for the age of the Universe in seconds.

age of the Universe = ... s [2]

(b) State when cosmic microwave background radiation (CMBR) was formed and where we detect it coming from.

.....

.....

.....

..... [2]

[Total: 7]

26. June/2023/Paper_0625/11/No.38

Which planet in our Solar System is nearest to the Sun and what is the nature of the planet?

	planet	nature
A	Mercury	rocky
B	Mercury	gaseous
C	Venus	rocky
D	Venus	gaseous

27. June/2023/Paper_0625/11/No.39

The Sun consists mostly of two elements.

What are these two elements?

A helium and nitrogen

B hydrogen and helium

C hydrogen and oxygen

D oxygen and nitrogen

28. June/2023/Paper_0625/11/No.40

Which statement about the Milky Way is correct?

A It is a galaxy.

B It is a group of galaxies.

C It is a group of stars outside our own galaxy.

D It is a group of stars which are part of our galaxy.

29. June/2023/Paper_0625/12/No.38

Which statement about the Solar System is correct?

A All the planets are rocky.

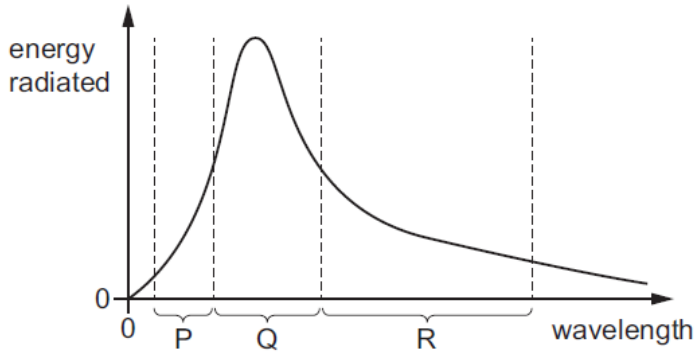
B Only the Earth has a moon.

C Pluto is a dwarf planet.

D There are many stars in the Solar System.

30. June/2023/Paper_0625/12/No.39

The graph shows the energy radiated by the Sun at different wavelengths. Most of the energy is radiated in just three parts of the electromagnetic spectrum, labelled P, Q and R.



Which parts of the electromagnetic spectrum are P and R?

	P	R
A	gamma ray	radio
B	infrared	ultraviolet
C	radio	gamma ray
D	ultraviolet	infrared

31. June/2023/Paper_0625/12/No.40

An astronomer observes redshift in the light from a distant galaxy.

Which statement about redshift is correct?

A It is the decrease in the observed wavelength of red light emitted from receding galaxies.

B It is evidence that the Universe is contracting and supports the Big Bang Theory.

C It is evidence that the Universe is expanding and supports the Big Bang Theory.

D Redshift is when light from receding galaxies appears blue.

32. June/2023/Paper_0625/13/No.38

Which row about the orbits of the Earth and the Moon is correct?

	approximate time for the Earth to orbit the Sun	approximate time for the Moon to orbit the Earth
A	1 day	30 days
B	30 days	1 day
C	365 days	1 day
D	365 days	30 days

33. June/2023/Paper_0625/13/No.39

Which description of a galaxy is correct?

A a collection of billions of stars

B a collection of gaseous planets orbiting a star

C a collection of rocky planets orbiting a star

D all of the stars that exist

34. June/2023/Paper_0625/13/No.40

Light from distant stars is redshifted.

What is redshift?

A a decrease in observed wavelength caused by a star moving away from the Earth

B a decrease in observed wavelength caused by a star moving towards the Earth

C an increase in observed wavelength caused by a star moving away from the Earth

D an increase in observed wavelength caused by a star moving towards the Earth

35. June/2023/Paper_0625/21/No.37

Which planet in our Solar System is nearest to the Sun and what is the nature of the planet?

	planet	nature
A	Mercury	rocky
B	Mercury	gaseous
C	Venus	rocky
D	Venus	gaseous

36. June/2023/Paper_0625/21/No.38

A space station orbits the Earth at a distance of 7000 km from the Earth's centre. It makes 15 orbits in every 24-hour period.

What is the speed of the space station in its orbit?

A 2900 km/h **B** 4400 km/h **C** 8800 km/h **D** 27 000 km/h

37. June/2023/Paper_0625/21/No.39

Which nuclear reaction powers a stable star?

A nuclear fission of nuclei producing hydrogen

B nuclear fission of a uranium nucleus into a krypton nucleus and a barium nucleus

C nuclear fusion of a krypton nucleus and a barium nucleus into a uranium nucleus

D nuclear fusion of hydrogen nuclei producing helium

38. June/2023/Paper_0625/21/No.40

Which stages in the life cycle of a star are listed in the order that they occur?

A interstellar dust cloud → stable star → protostar

B protostar → red giant → stable star

C red giant → white dwarf → protostar

D stable star → red giant → white dwarf

39. June/2023/Paper_0625/22/No.37

Which statement about the Solar System is correct?

A All the planets are rocky.

B Only the Earth has a moon.

C Pluto is a dwarf planet.

D There are many stars in the Solar System.

40. June/2023/Paper_0625/22/No.38

Comets are bodies which orbit the Sun in the Solar System.

What is the shape of the orbit and how is the Sun positioned within the orbit?

	shape of orbit	position of the Sun
A	circular	centre of orbit
B	circular	**not** at centre of orbit
C	elliptical	centre of orbit
D	elliptical	**not** at centre of orbit

41. June/2023/Paper_0625/22/No.39

Which nuclear reaction produces the release of energy to power a star?

A nuclear fission of helium into hydrogen

B nuclear fission of hydrogen into helium

C nuclear fusion of helium into hydrogen

D nuclear fusion of hydrogen into helium

42. June/2023/Paper_0625/22/No.40

What is the definition of the Hubble constant?

A the ratio of the speed at which a galaxy is receding from the Earth to its distance from the Earth

B the value of the change in wavelength of the galaxy's starlight due to redshift

C the constant used to represent the rate of expansion of the Universe in all directions

D the estimated constant equal to the age of the Universe

43. June/2023/Paper_0625/23/No.37

Which row about the orbits of the Earth and the Moon is correct?

	approximate time for the Earth to orbit the Sun	approximate time for the Moon to orbit the Earth
A	1 day	30 days
B	30 days	1 day
C	365 days	1 day
D	365 days	30 days

44. June/2023/Paper_0625/23/No.38

Which statement about the orbits of comets is correct?

A Comets have elliptical orbits and the Sun is at the centre of the orbit.

B Comets have elliptical orbits and the Sun is **not** at the centre of the orbit.

C Comets have circular orbits and the Sun is at the centre of the orbit.

D Comets have circular orbits and the Sun is **not** at the centre of the orbit.

45. June/2023/Paper_0625/23/No.39

Which row describes the power source for a stable star?

	type of nuclear reaction	fuel
A	fission	hydrogen
B	fission	uranium
C	fusion	hydrogen
D	fusion	uranium

46. June/2023/Paper_0625/23/No.40

Which quantity can be determined using the brightness of a supernova in a distant galaxy?

A the speed at which the galaxy is moving away from the Earth

B the distance of the galaxy from the Earth

C the Hubble constant

D the age of the Universe

47. June/2023/Paper_0625/31/No.12

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

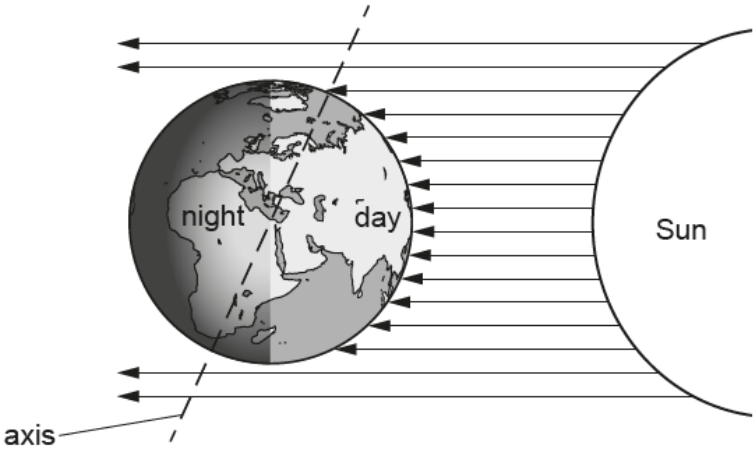


Fig. 12.1 (not to scale)

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]

48. June/2023/Paper_0625/32/No.11

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

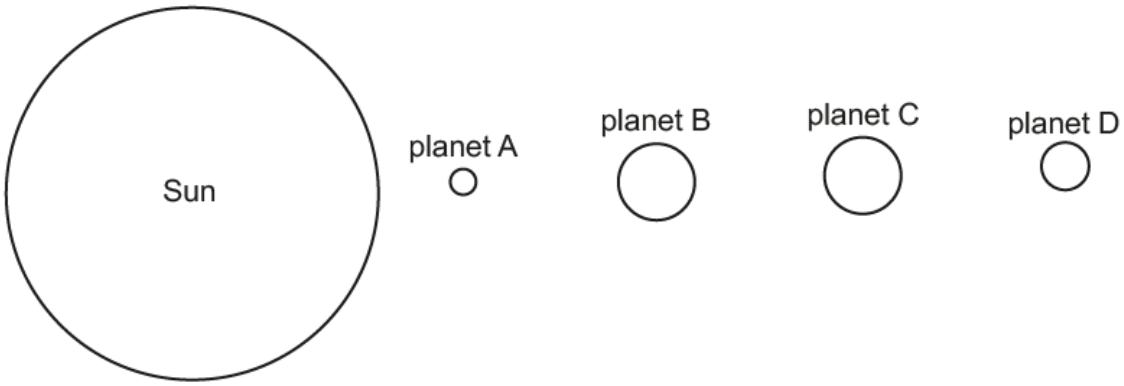


Fig. 11.1 (not to scale)

(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]

(b) Describe how the four innermost planets of the Solar System were formed.

.....

.....

.....

..... [4]

[Total: 6]

49. June/2023/Paper_0625/33/No.10

Fig. 10.1 represents part of the Solar System.

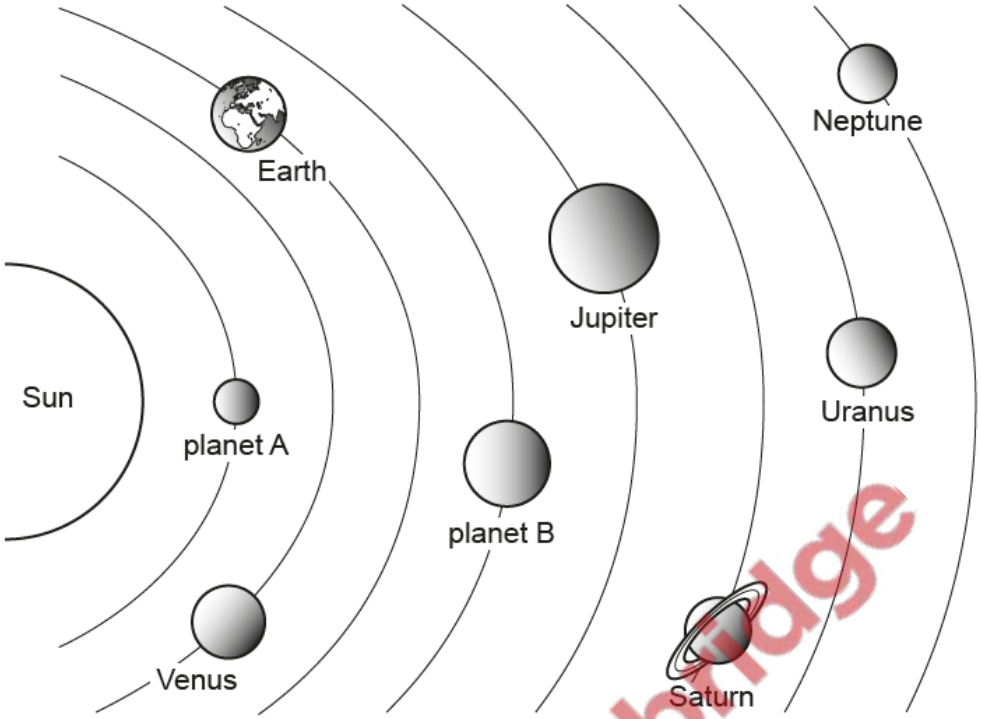


Fig. 10.1 (not to scale)

(a) (i) State the name of planet A and the name of planet B.

planet A .....

planet B .....

[2]

(ii) On Fig. 10.1, draw an X to represent a moon of Jupiter. Draw a line to show how this moon moves. [1]

(iii) State **two** ways in which the four planets nearest to the Sun are different from the four planets furthest away from the Sun.

1 .....

2 .....

[2]

(iv) Complete the following sentences:

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

The ..... includes billions of galaxies.

[2]

(b) The distance between the Sun and the Earth is 1.5×10^{11} m.
The speed of an electromagnetic wave is 3.0×10^{8} m/s.

Calculate the time taken for an electromagnetic wave to travel from the Sun to the Earth.

time taken = ... s [3]

[Total: 10]

50. June/2023/Paper_0625/41/No.10

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

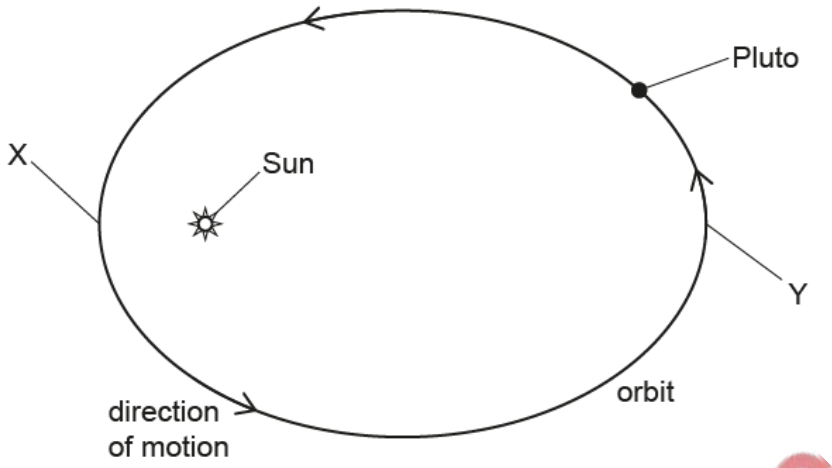


Fig. 10.1 (not to scale)

(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.

.....

..... [1]

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

.....

.....

.....

..... [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.

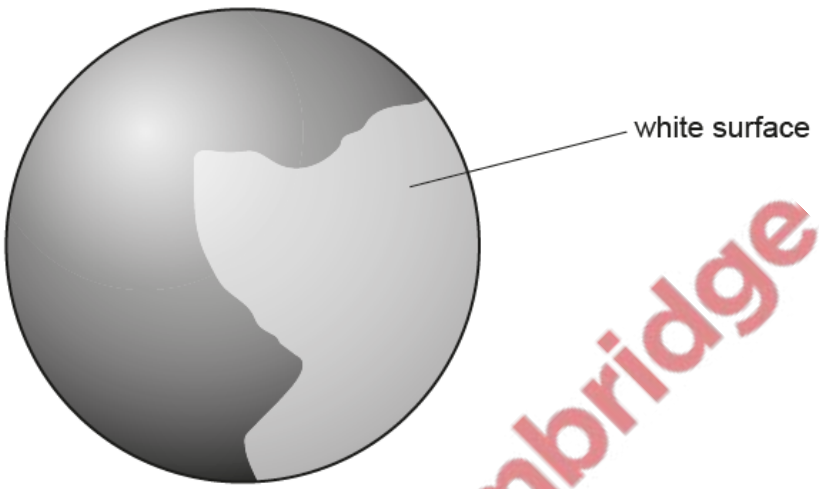


Fig. 10.2

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

.....

.....

.....

..... [2]

[Total: 7]

51. June/2023/Paper_0625/42/No.10

(a) State the equation that defines the average orbital speed v of a planet. State the meaning of any symbols you use.

.....

..... [2]

(b) Suggest why countries that are a significant distance from the Equator experience significant temperature variation throughout the year.

.....

.....

..... [1]

(c) Fill in the gaps in the paragraph about a star much more massive than the Sun.

The stage that follows the stable state in the life cycle of the star is the

..... stage.

It then explodes as a supernova to form a ..... , this leaves behind a

..... or a ..... .

[4]

(d) A galaxy is moving away from the Earth with a speed of 33 000 km/s.
The value of the Hubble constant is 2.2×10^{-18} per second.

Calculate the distance from the galaxy to the Earth. Give your answer in light-years.

distance = ... light-years [2]

[Total: 9]

52. June/2023/Paper_0625/43/No.9

Fig. 9.1 shows the Sun as the central dot and the planets Saturn, Jupiter and Earth labelled S_0, J_0 and E_0. The planets orbit the Sun anticlockwise. From the Earth's orbit, the planets appear aligned.

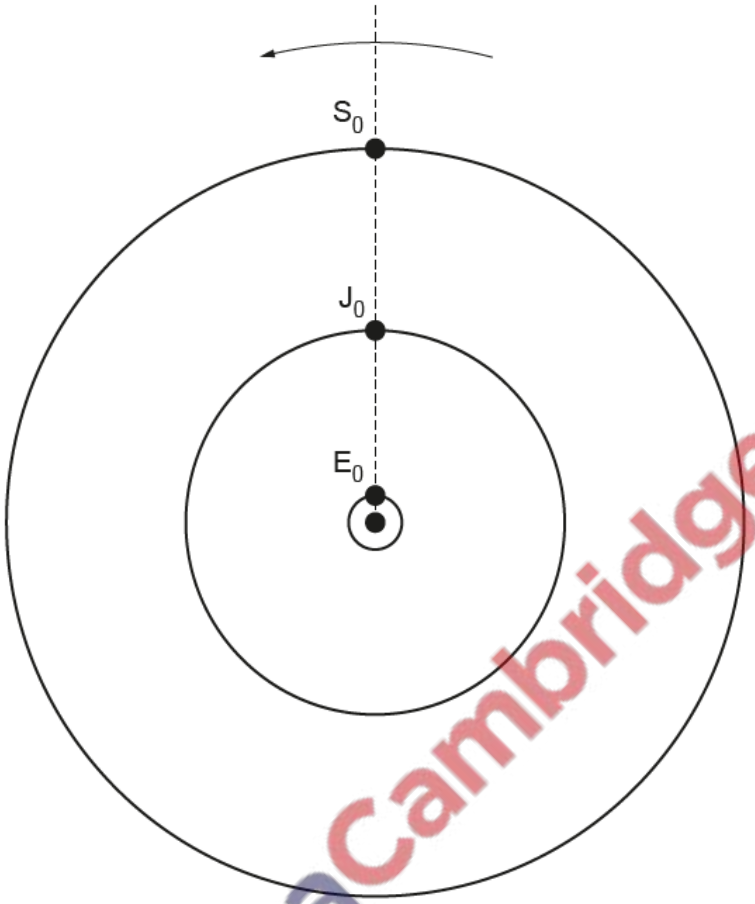


Fig. 9.1 (not to scale)

Assume that Saturn takes 30 years to orbit the Sun and that Jupiter takes 12 years to orbit the Sun.

(a) On Fig. 9.1, mark the positions of Saturn and Jupiter 5.0 years after the original positions shown.

Label these positions S_1 and J_1. Show your working.

[3]

(b) **(i)** On Fig. 9.1, mark the positions of Saturn and Jupiter 20 years after the original positions shown in Fig. 9.1.

Label these positions S_2 and J_2.

[1]

(ii) State what is observed from the Earth's orbit after 20 years.

.....

..... [1]

(c) **(i)** Choose **two** words from the list to describe **each** planet.

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

Jupiter .....

Earth .....

[1]

(ii) The average density of Jupiter is much less than that of the Earth.
The gravitational field strength at the surface of Jupiter is greater than that at the surface of the Earth.

Explain how these differences in density and in gravitational field strength are consistent with your answers to **(c)(i)**.

density

.....

.....

gravitational field strength

.....

.....

[3]

(d) The average density of Jupiter is $1300\,kg/m^3$ and its volume is $1.4 \times 10^{15}\,km^3$.

Calculate the mass of Jupiter.

mass = ... [3]

[Total: 12]

53. June/2023/Paper_0625/43/No.10

(a) Show that 1 light-year = 9.5×10^{15} m.

[4]

(b) **(i)** State **one** measurement that is taken when determining the speed v at which a galaxy is moving away from the Earth.

.....

..... [1]

(ii) Write down an equation relating v and the distance d of a far galaxy.

..... [1]

(iii) State how the distance d of a far galaxy can be determined other than by using the equation in **(ii)**.

.....

..... [1]

[Total: 7]