Cambridge Assessment International Education

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CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

2767985699

PHYSICS **0625/33**

Paper 3 Theory (Core) **October/November 2023**

1 hour 15 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.
- Take the weight of 1.0 kg to be 9.8 N (acceleration of free fall = 9.8 m/s^2).

INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages.

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1 Fig. 1.1 shows the speed–time graph for a bus journey.

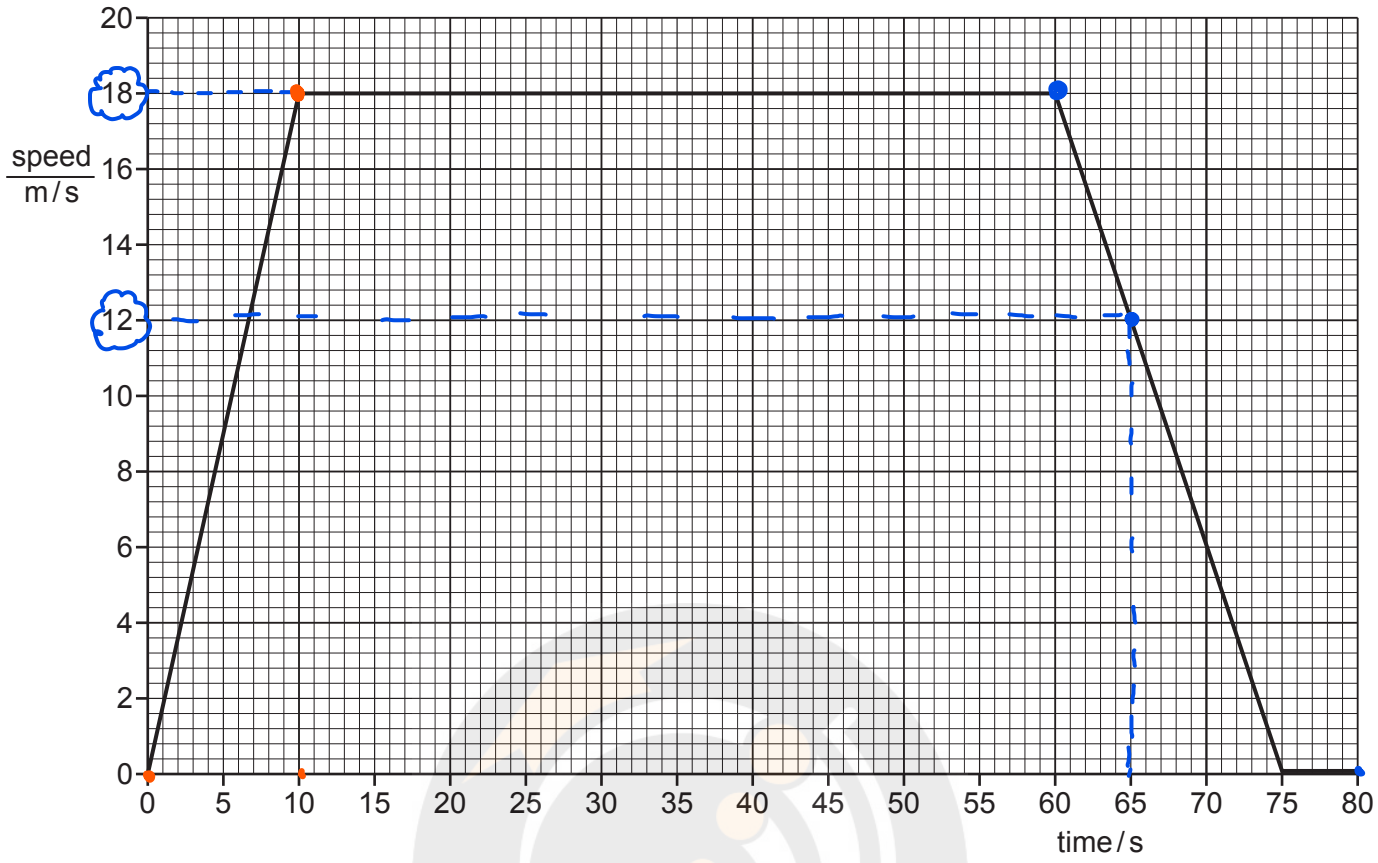

Fig. 1.1

(a) Using the information in Fig. 1.1, determine:

(i) the maximum speed of the bus during the journey

maximum speed = 18 m/s [1]

(ii) the speed of the bus at time = 65 s. On Fig. 1.1, show how you obtained this information.

speed = 12 m/s [2]

(b) Describe how the speed of the bus changes between time = 60 s and time = 80 s.

from 60s speed starts to decrease with a constant rate and comes to rest at 75 sec. & stays at rest for another 5 sec. [2]

(c) Determine the distance travelled by the bus between time = 0 and time = 10 s.

Area under speed-time graph will give the distance travelled.

$A = \frac{1}{2} \times 10 \times 18$ 9

distance travelled = 90 m [3]

(d) Fig. 1.2 shows the speed–time graph for another bus journey.

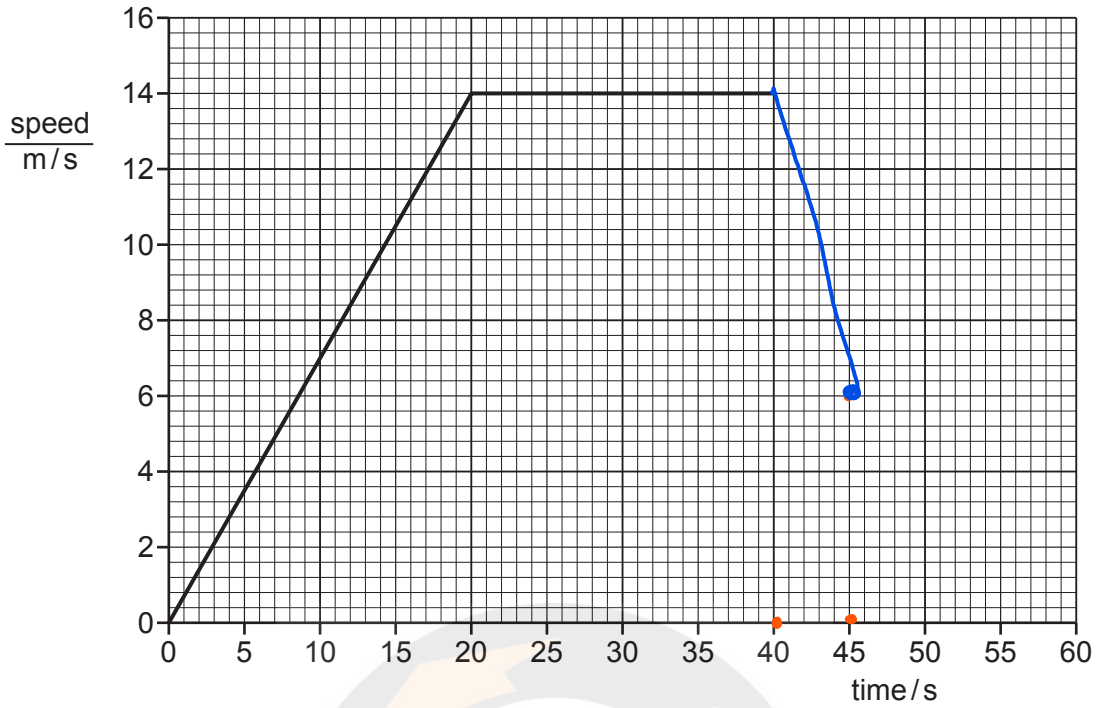

Fig. 1.2

The driver sees a hazard ahead and applies the brakes at time = 40 s.

The bus reduces its speed from 14.0 m/s to 6.0 m/s in a time of 5.0 s.

On Fig. 1.2, draw the speed–time graph for the bus as it reduces its speed. [2]

[Total: 10]

2 A farmer uses a rope to lift a barrel of fruit from the ground to a platform, as shown in Fig. 2.1.

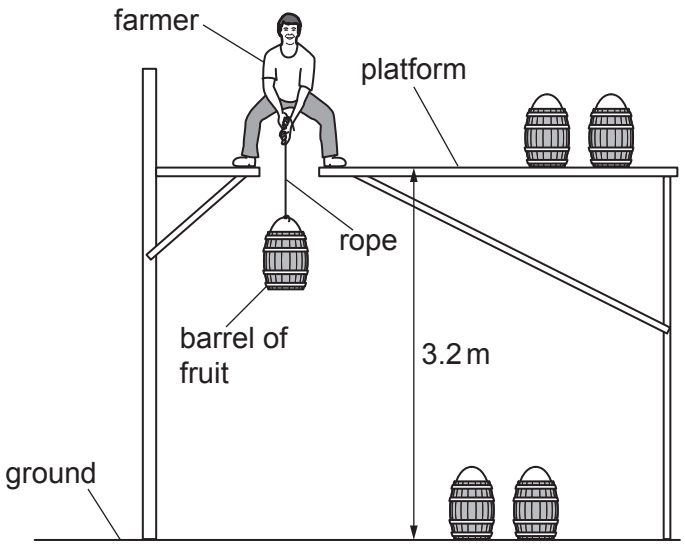

Fig. 2.1

(a) The farmer lifts the barrel of fruit at a constant speed.

(i) State the energy store of the barrel of fruit that increases as the barrel rises.

Gravitational Potential energy [1]

(ii) The weight of the barrel of fruit is 140 N.

Show that the work done on the barrel of fruit in lifting it from the ground to the platform is approximately 450 J.

$W = F \times x$

$= 140 \times 3.2$

$\approx 450\,J$

[2]

(b) The farmer wants to make the process faster. He buys a machine to lift the barrels of fruit.

(i) The output power of the machine is 75 W.

The work done in lifting a barrel of fruit onto the platform is 450 J.

Calculate the time taken for the machine to lift a barrel of fruit onto the platform.

$P_{avg} = \frac{W}{t}$ $\quad t = \frac{450}{75}$

time = 6 s [3]

(ii) The machine uses an electric motor. The farmer installs some wind turbines to supply electrical power for the farm.

Suggest **one** environmental reason for using wind turbines rather than using a diesel (fossil fuel) generator.

Greenhouse gases will not be produced.

[1]

[Total: 7]

3 The mass of a glass bottle is 0.18 kg.

(a) Calculate the weight of the bottle.

$W = 0.18 \times 9.8$

weight = 1.77 N [2]

(b) The bottle contains 2.7 kg of cooking oil. The density of the cooking oil is 0.92 g/cm^3.

Calculate the volume of the cooking oil.

$D = \frac{M}{V} \Rightarrow V = \frac{M}{D} = \frac{2.7 \times 10^3}{0.92}$ $\frac{2700}{0.92}$

volume = 2935 cm^3 [4]

(c) A cookery student pours some cooking oil into a glass bowl containing water, as shown in Fig. 3.1.

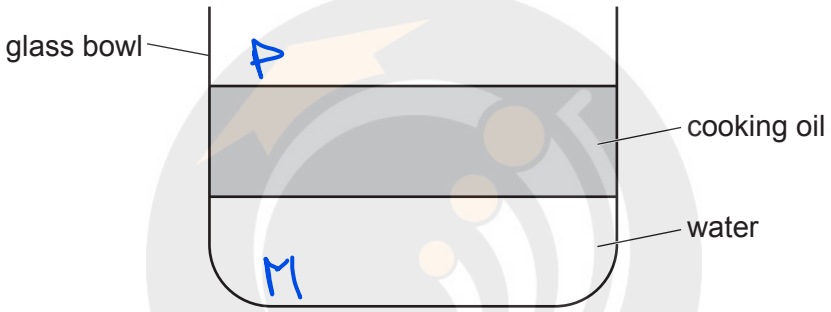

Fig. 3.1

The student accidently drops a plastic spoon and a metal spoon into the bowl.
The densities of the spoons and liquids are shown in Table 3.1.

Table 3.1

material	density / g/cm^3
plastic spoon	0.76
metal spoon	8.7
cooking oil	0.92
water	1.0

On Fig. 3.1, label a suggested position for each spoon after each has fallen into the bowl.

Use the letter P to label the position of the plastic spoon and the letter M to label the position of the metal spoon. [2]

[Total: 8]

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4 **(a)** Fig. 4.1 shows a pan on a hotplate. The hotplate heats the pan and the water.

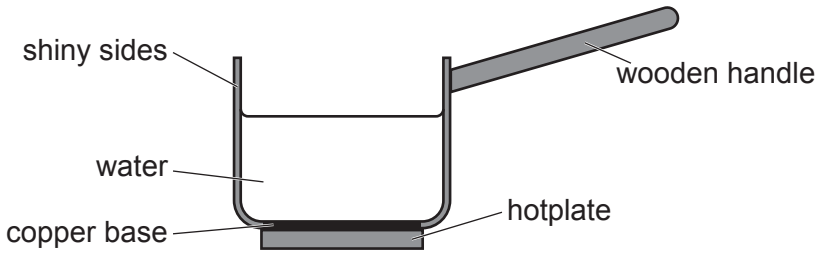


Fig. 4.1

Use your ideas about thermal energy transfer to explain why the pan has:

(i) a wooden handle

To prevent heating of the handle as wood is a poor conductor of Heat. [1]

(ii) shiny sides

Shiny object are poor emitters of infrared radiations. [2]

(iii) a copper base.

Copper is a good conductor of Heat. [1]

(b) Fig. 4.2 shows a heater for warming a room. When there is hot water in the heater, thermal energy transfers from the water to the room.

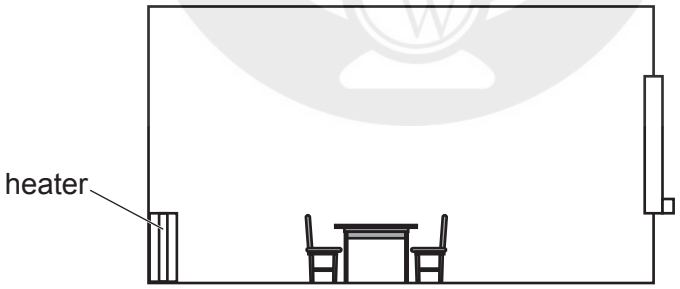


Fig. 4.2

Explain how thermal energy from the heater warms the entire room. Use your ideas about the density of air. You may draw on Fig. 4.2.

As the air near the heater heats up, it expands and becomes less dense and the colder air pushes the hotter air in upward direction and convection current is set up. [4]

[Total: 8]

5 **(a)** Fig. 5.1 shows regions of the electromagnetic spectrum in order of increasing wavelength. **Two** of the regions are unlabelled.

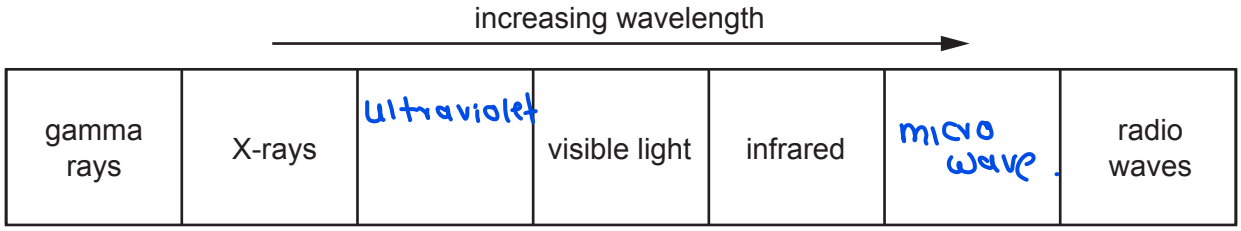


Fig. 5.1

(i) Complete Fig. 5.1 by writing the name of each unlabelled region in the correct box. [2]

(ii) State **two** properties that are the same for all regions of the electromagnetic spectrum.

1 Non-mechanical : They do not require material medium to propogate

2 Same speed in Vacuum $c = 3 \times 10^8$ m/s.

[2]

(b) **(i)** State **one** use for infrared radiation.

Remotes for short range [1]

(ii) State **one** harmful effect of excessive exposure to infrared radiation.

Skin burn [1]

[Total: 6]

6 **(a)** A student shines a ray of red light into a rectangular glass block, as shown in Fig. 6.1.

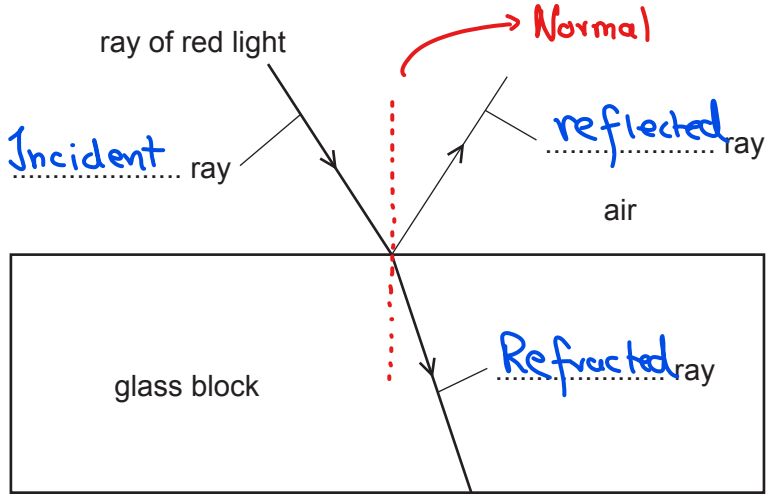


Fig. 6.1

(i) Draw the normal at the point where the ray of red light enters the glass block. [1]

(ii) On Fig. 6.1, label each ray using words from the list.

diffracted **diffused** **dispersed** **incident** **reflected** **refracted**

[2]

(b) Fig. 6.2 and Fig. 6.3 each show two parallel rays of light travelling through air towards a lens.

For each lens, draw the path of the two rays as they pass through the lens and back into the air.

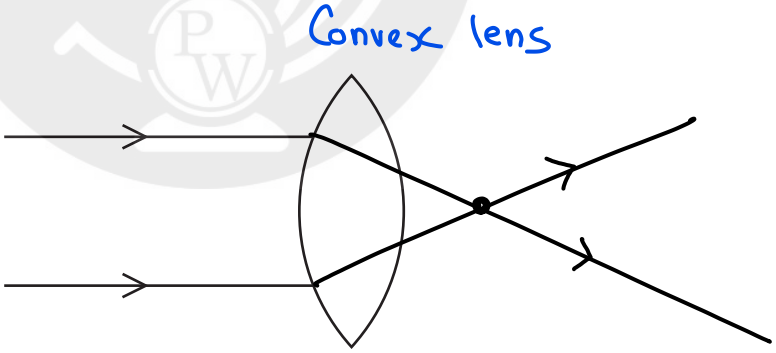


Fig. 6.2

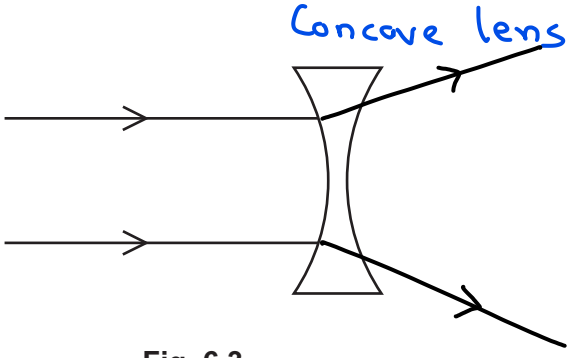


Fig. 6.3

[2]

(c) State the **seven** colours of visible light. Give the colours in order of frequency.

frequency	colour
greatest ↑	Violet
	Indigo
	Blue
	Green
	Yellow
	Orange
smallest	Red

λ_{min}

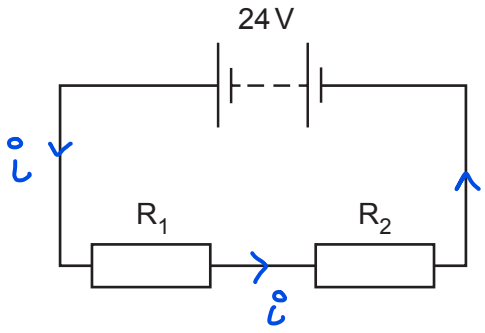
↑ wavelength decreases.

λ_{max}

[2]

[Total: 7]

7 Two identical resistors, R_1 and R_2, are connected to a 24 V battery, as shown in Fig. 7.1.



i → same

$R_{eq} = R_1 + R_2$
$= 100\,\Omega$

Fig. 7.1

The value of each resistor is 50 Ω.

(a) Calculate the combined resistance of R_1 and R_2 when they are connected as shown in Fig. 7.1.

combined resistance = ... 100 ..... Ω [1]

(b) Show that the current in the circuit is approximately 0.25A.

$i = \frac{V}{R} = \frac{24}{100} = 0.24\,A$

[3]

(c) Determine the potential difference (p.d.) across R_1.

$V_1 = iR_1$
$= 0.25 \times 50$

p.d. = ... 12 ..... V [1]

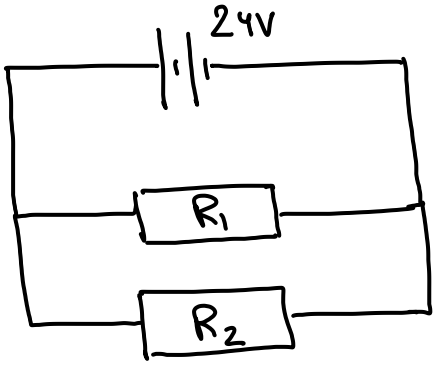
(d) Calculate the power transferred in R_1.

$P = i^2R$
$= (0.25)^2 \times 50$

power = ... 3·125 ..... W [3]

(e) A student connects R_1, R_2 and the battery to make a different circuit. The resistors R_1 and R_2 are connected so their combined resistance is as small as possible.

Draw a circuit diagram to show how R_1 and R_2 are connected to the battery.



$R_{eq} = \frac{R_1R_2}{R_1+R_2}$
$= 25\,\Omega$

[1]

[Total: 9]

8 **(a)** Fig. 8.1 shows an arrangement for transmitting electricity generated by a power station.

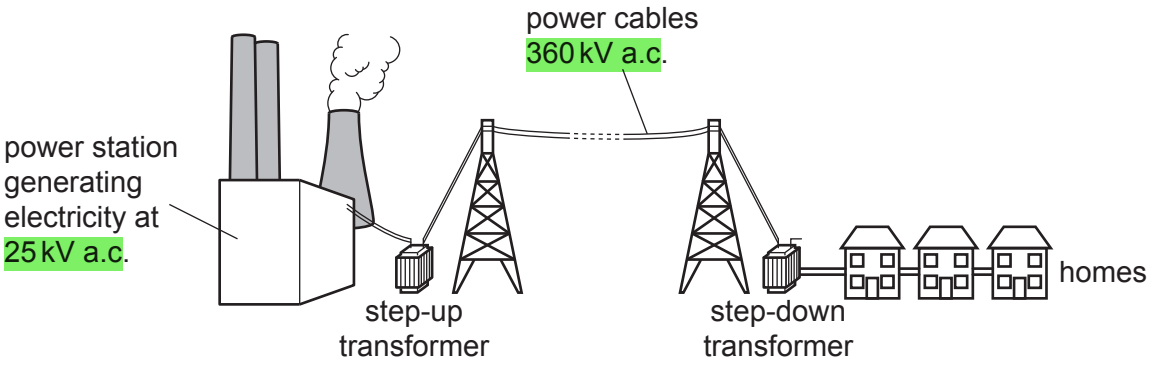


Fig. 8.1 (not to scale)

The step-up transformer has 500 turns on the primary coil.

Calculate the number of turns on the secondary coil of the step-up transformer. Use the information given in Fig. 8.1.

$\frac{N_P}{N_S} = \frac{V_P}{V_S}$

$N_S = \frac{V_S}{V_P} \times N_P = \frac{360\,kV}{25\,kV} \times 500$

number of secondary turns = 7200 [3]

(b) State **two** benefits of using high voltages for transmitting electricity.

1 less loss of energy

2 Because of lower current thinner wires can be used.

[2]

[Total: 5]

9 **(a)** Describe what is meant by alternating current (a.c.).

Alternating current are current whose direction chages Periodically. [1]

(b) A teacher demonstrates how a loudspeaker works by using the equipment shown in Fig. 9.1.

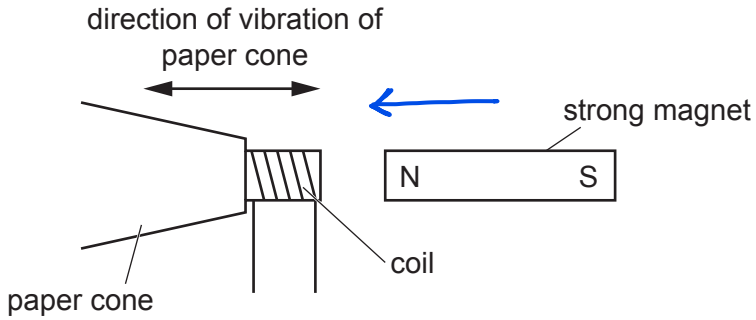


Fig. 9.1

There is an alternating current in the coil. The paper cone and coil vibrate as shown in Fig. 9.1.

(i) Explain why the paper cone vibrates. Use your ideas about magnetism.

When magnet is brought near to coil, induced current is produced in the coil which resists the moving magnet and hence the cone vibrates [3]

(ii) When the paper cone vibrates, the teacher hears a sound.

Suggest a value for the frequency of the alternating current. Include the unit.

frequency = 20 – 20k Hz

unit Hz or s^{-1}

[2]

[Total: 6]

10 **(a)** Fig. 10.1 represents all the particles in a lithium atom.

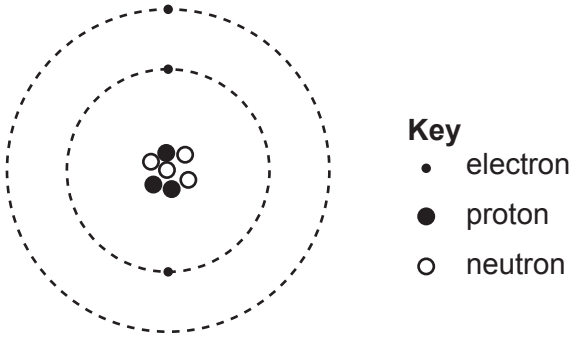


Fig. 10.1 (not to scale)

(i) State the proton number (atomic number) of the lithium atom in Fig. 10.1.

3 [1]

(ii) Determine the nucleon number (mass number) of the lithium atom in Fig. 10.1.

P+N

nucleon number = 7 [1]

(iii) Describe how a lithium atom changes to form a positive ion. $Li \rightarrow Li^+ + e^-$

loosing an electron. [1]

(b) The half-life of iodine-131 is 8 days. A sample contains 80 mg of iodine-131.

Calculate the time taken to decay until 10 mg of iodine-131 remain in the sample.

80mg $\xrightarrow{1}$ 40 $\xrightarrow{2}$ 20 $\xrightarrow{3}$ 10

time taken = $3 \times 8 = 24$ days [2]

[Total: 5]

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

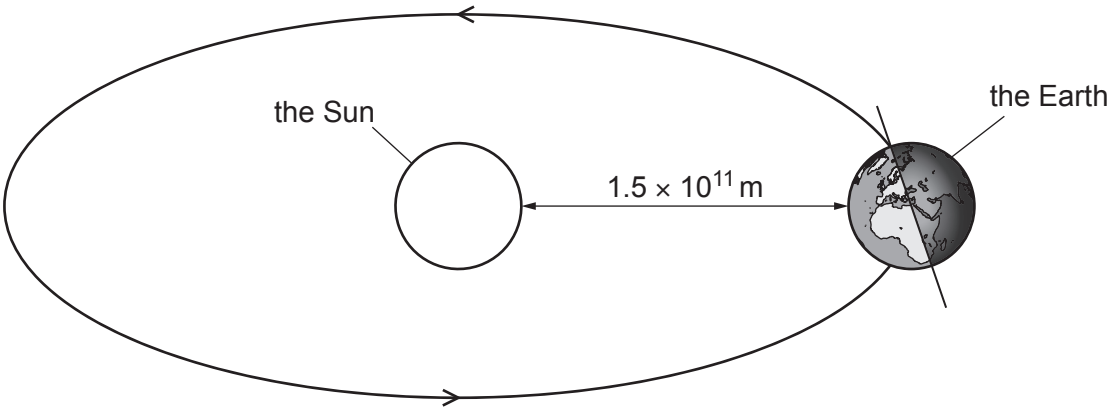

Fig. 11.1 (not to scale)

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

Gravitational force [1]

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

time for **one** orbit = $365\frac{1}{4}$ days [1]

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

time for **one** rotation = 24 hours [1]

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

Hydrogen and Helium [2]

Question continued on next side

(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.

Ultraviolet radiation and Infrared radiation [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.

$D = 1.5 \times 10^{11}$ m

$t = \frac{1.5 \times 10^{11} \times 10^3}{3 \times 10^8}$

$= \frac{50}{150} \times 10$

$= \frac{500}{3}$

time taken = 500 s [3]

[Total: 9]

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