

CANDIDATE
NAME

SOLVED BY SMART EXAM RESOURCES

CENTRE
NUMBER

--	--	--	--	--

CANDIDATE
NUMBER

--	--	--	--

PHYSICS

0625/42

Paper 4 Theory (Extended)

May/June 2019

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your centre number, candidate number and name on all the work you hand in.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

DO NOT WRITE IN ANY BARCODES.

Answer **all** questions.

Electronic calculators may be used.

You may lose marks if you do not show your working or if you do not use appropriate units.

Take the weight of 1.0 kg to be 10 N (acceleration of free fall = 10 m/s^2).

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

This syllabus is regulated for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **15** printed pages and **1** blank page.



- 1 A bus is travelling between points A and D. There are bus stops at A, B, C and D but the bus does not stop at B and C. Fig. 1.1 is a speed-time graph for the bus.

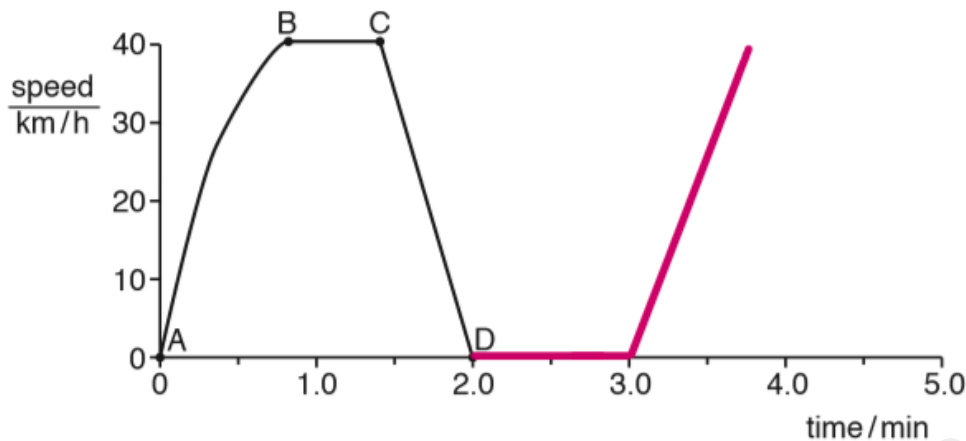


Fig. 1.1

- (a) Describe the motion of the bus between each of the bus stops. Select the appropriate description from the list below.

constant acceleration decreasing acceleration
 increasing acceleration moving backwards at constant speed
 moving forwards at constant speed stationary

1. between A and B **Decreasing acceleration**
 2. between B and C **Moving forward at constant speed**
 3. between C and D **Constant acceleration**

[3]

- (b) The average speed of the bus between A and D is 23 km/h.

Calculate the distance between A and D.

$$\begin{aligned} \text{Average speed} &= \frac{[\text{Total distance}]}{[\text{Total time}]} \\ \therefore \text{Total distance} &= \text{Av. speed} \times \text{total time} \\ &= 23 \times \frac{2}{60} \\ &= 0.77 \text{ km} \end{aligned}$$

distance = **0.77 km** [3]

- (c) The bus stops at D for 1 min and then travels at a constant acceleration for 30 seconds.

On Fig. 1.1, sketch a possible graph for this additional motion. Label X when the bus starts to accelerate and label Y for 30 seconds later. [3]

[Total: 9]

- 2 Fig. 2.1 shows a model fire engine. Its brakes are applied.

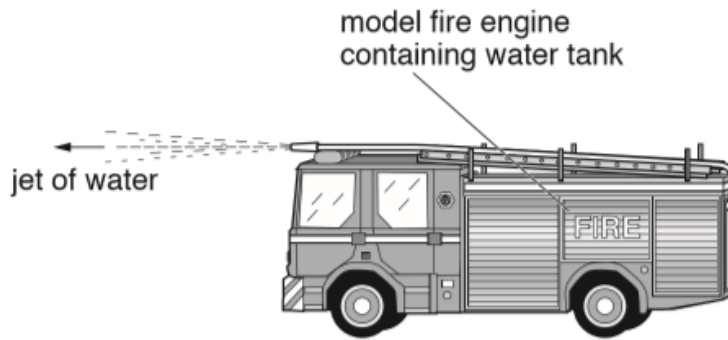


Fig. 2.1

0.80 kg of water is emitted in the jet every 6.0 s at a velocity of 0.72 m/s relative to the model.

- (a) Calculate the change in momentum of the water that is ejected in 6.0 s.

$$\Delta p = (\text{Change in momentum}) = mv - mu = m(v - u) \quad \therefore p = 0.80 \times (0.72 - 0) = 0.576 = 0.58 \text{ kg m/s}$$

momentum = 0.58 kg m/s [2]

- (b) Calculate the magnitude of the force acting on the model because of the jet of water.

$$F = ma \quad Ft = \Delta p \quad \therefore F = \frac{0.58}{6} = 0.096 \text{ N}$$

$$F = \frac{m(v - u)}{t} \quad \therefore F = \frac{\Delta p}{t}$$

force = 0.096 N [2]

- (c) The brakes of the model are released.

State and explain the direction of the acceleration of the model.

Statement Acceleration is backwards

Explanation Force from water is backwards

[2]

- (d) In (c) the model contains a water tank, which is initially full.

State and explain any change in the magnitude of the initial acceleration if the brakes are first released when the tank is nearly empty.

Statement Acceleration is more when empty.

Explanation $F = ma \Rightarrow a = F \div m$

Since force (F) = constant and mass decreases, the acceleration increases.

[3]

- 3 Fig. 3.1 shows solar cells used to generate electrical energy.

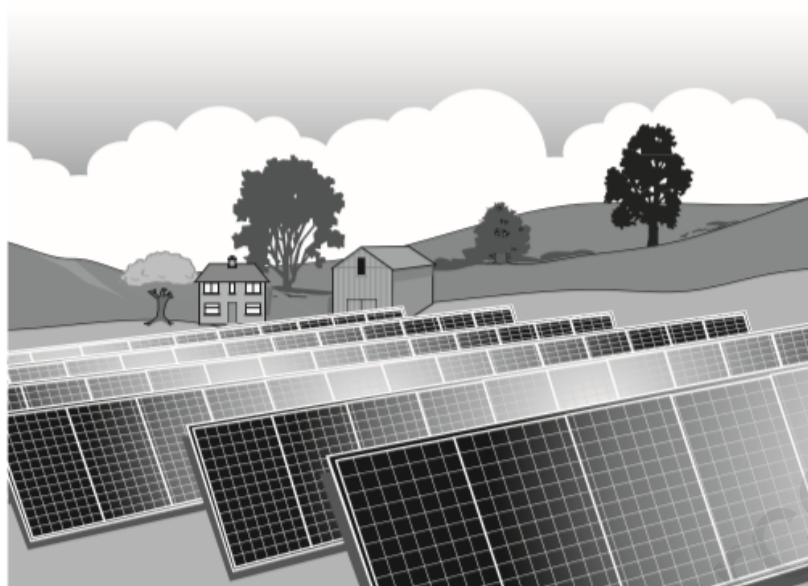


Fig. 3.1

- (a) State the main form of energy transferred from the Sun to the solar cells for the generation of electrical energy.

Light

[1]

- (b) Consider the generation of electrical energy by a large number of solar cells, as shown in Fig. 3.1.

- (i) State **one** environmental advantage and **one** environmental disadvantage.

advantage No air pollution [OR] No greenhouse gases/global warming/
disadvantage Visual pollution

[2]

- (ii) State and explain whether this source of electrical energy is renewable.

Yes. It is renewable and nothing is used up [OR] Solar energy is available in abundance

[1]

- (c) Each group of solar cells is arranged in a rectangle $1.2\text{ m} \times 2.8\text{ m}$. The solar cells are situated in a region where 260 W of solar energy is received per square metre of the cells. The electrical output of each group of solar cells is a current of 2.5 A with a potential difference of 86 V .

Calculate the efficiency of the solar cells.

$$\text{Area of cell} = 1.2\text{ m} \times 2.8\text{ m}$$

$$\text{Power} = 260\text{ W/sq.m of cells}$$

$$\text{Electrical Output} = 2.5\text{ A}, 86\text{ V}$$

$$\therefore \text{Power Out} = 2.5 \times 86 = 215$$

\therefore Efficiency of
Solar cells

$$\text{efficiency} = \dots\dots\dots 25\% \dots\dots\dots \% \quad [4]$$

[Total: 8]

$$= \frac{\text{Power out}}{\text{Power In}} \times 100 = \frac{215}{1.2 \times 2.8 \times 260} \times 100$$

$$= 24.61\%$$

$$= 25\%$$

- 4 (a) State and explain, in terms of molecules, any change in the pressure of a gas when the volume is reduced at a constant temperature.

Statement *Pressure increases*

Explanation *Molecules travel shorter average distance between collisions with walls. Also molecules hit the wall often.*

[3]

- (b) Complete Table 4.1 to give the relative order of magnitude of the expansion of gases, liquids and solids for the same increase of temperature.

Write one of these words in each blank space:

gas liquid solid

Table 4.1

expands most	<i>Gas</i>
expands least	<i>Solid</i>

[2]

[Total: 5]

- 5 (a) (i) A liquid is heated so that bubbles of its vapour rise to the surface and molecules escape to the atmosphere.

State the name of this process Boiling [1]

- (ii) At a lower temperature than in (a)(i), molecules escape from the surface to the atmosphere.

State the name of this process Evaporation [1]

- (b) (i) Fig. 5.1 shows apparatus used to determine the power output of a heater.

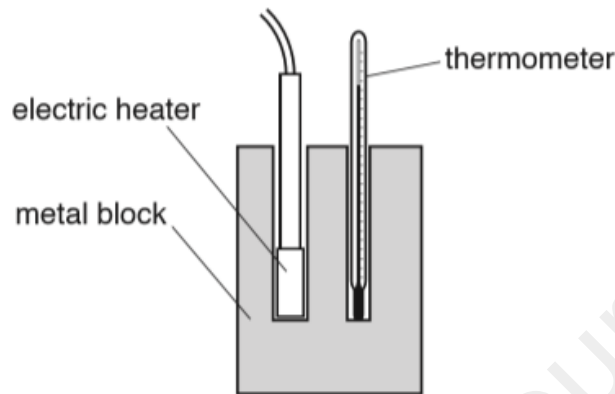


Fig. 5.1

The metal block has a mass of 2.7 kg. The metal of the block has a specific heat capacity of $900 \text{ J}/(\text{kg } ^\circ\text{C})$.

In 2 min 30s, the temperature of the block increases from 21°C to 39°C . $\Delta\theta = (39 - 21) = 18^\circ\text{C}$

Calculate the power of the heater.

$$E = mc\Delta\theta; \quad m = 2.7 \text{ kg}; \quad c = 900 \text{ J}/\text{kg}^\circ\text{C} \quad \Delta\theta = 18^\circ\text{C}$$

$$\therefore E = 2.7 \times 900 \times 18$$

$$E = 43740 \text{ J}$$

$$P = \frac{E}{t} = \frac{43740}{150}$$

$$\therefore P = 291.6 \text{ W}$$

$$\therefore P = 291.6 \text{ W or } 290 \text{ W}$$

power = 290W [4]

- (ii) State and explain a precaution that can be taken to improve the accuracy of the experiment.

Statement Use lagging

Explanation Reduction of thermal energy losses.

[2]

[Total: 8]

- 6 (a) Fig. 6.1 shows a water wave in a ripple tank.

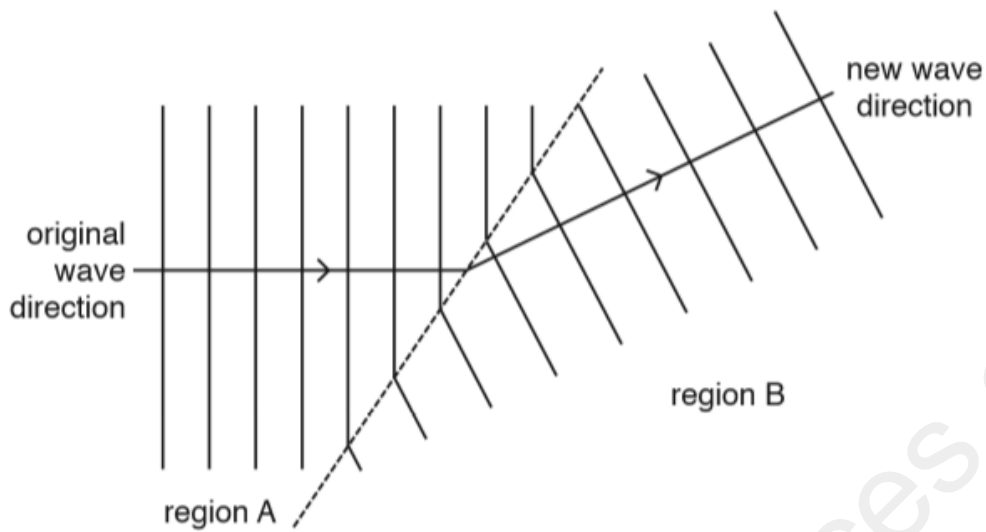


Fig. 6.1

- (i) State the name of the process that occurs as the wave moves from region A to region B.

Refraction

[1]

- (ii) Suggest a cause for the change in direction of the wave.

Waves moves faster in region B

[1]

(b) Fig. 6.2 shows a transverse wave.

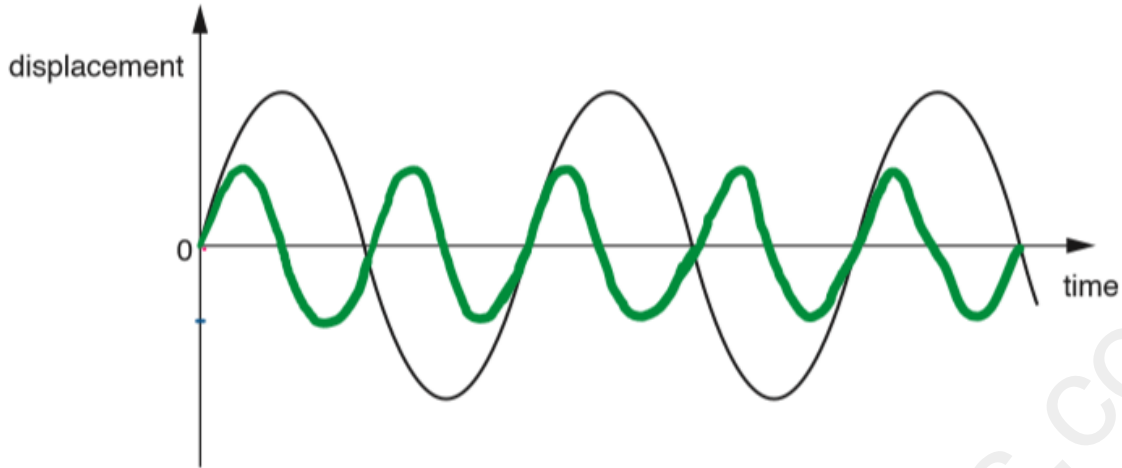


Fig. 6.2

On Fig. 6.2, draw a wave which has half the amplitude and a greater frequency than the wave shown. [2]

(c) A train travels along steel rails. A person waiting at a station hears the sound of the train through the rails before he hears the sound through the air.

(i) Explain why this happens.

Sound travels faster in metals

[1]

(ii) The speed of sound in the rails is 5800 m/s.

Calculate the wavelength of sound of frequency 1100 Hz travelling at this speed.

$$v = 5800 \text{ m/s}$$

$$f = 1100 \text{ Hz}$$

$$\lambda = ?$$

$$v = f\lambda$$

$$5800 = 1100(\lambda)$$

$$\text{wavelength} = \dots\dots\dots 5.3 \text{ m} \dots\dots\dots [2]$$

[Total: 7]

$$\therefore \lambda = \frac{5800}{1100} = 5.3 \text{ m}$$

- 7 (a) In Fig. 7.1, a converging lens projects a sharp image of an object O on to a screen. Complete the paths of the two rays from the object to the screen.

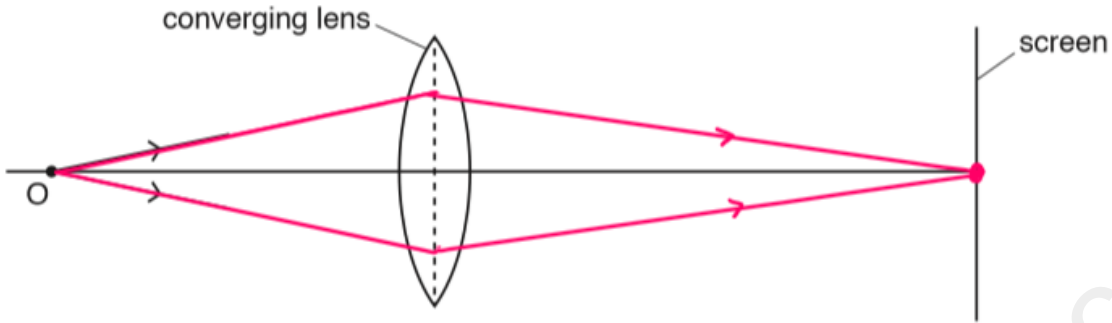


Fig. 7.1

[2]

- (b) The converging lens in (a) is replaced with a thinner converging lens. The object O and the screen remain in the same positions as in (a). The thinner converging lens has a longer focal length than the converging lens in (a).

Complete the paths of the two rays from the object to the screen in Fig. 7.2.

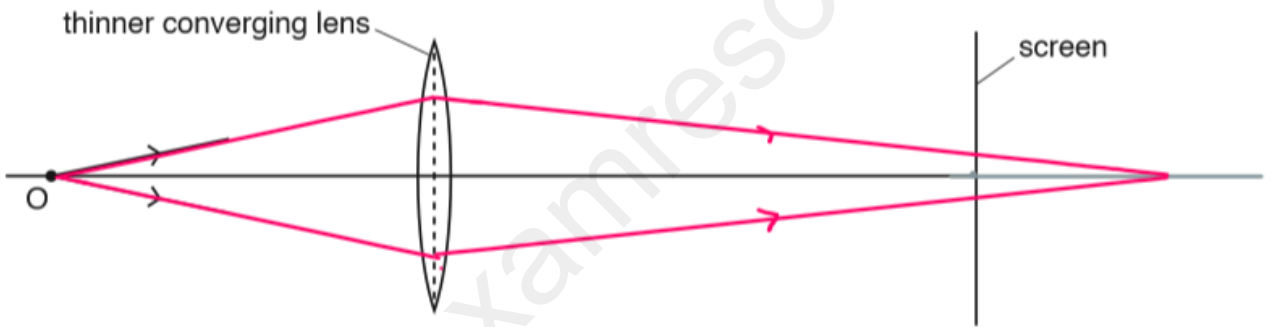


Fig. 7.2

[2]

- (c) A converging lens is used as a magnifying glass. The focal length of the lens is 10 cm.

(i) Describe the position of the object in relation to the lens.

Object is closer to lens than one focal length. [1]

(ii) Describe the position of the image in relation to the lens and the object.

Image is on the same side of the lens as the object. OR Image is further from lens. [1]

(iii) Give three properties of the image formed by a magnifying glass.

1. Image is enlarged
 2. Image is upright
 3. Image is virtual
- [2]

[Total: 8]

- 8 (a) A conducting sphere is mounted on an insulating stand. Explain how you would use a positively charged rod of insulating material to charge the sphere by induction.

1. Bring a charged rod close to the sphere
 2. Earth the sphere
 3. Remove earthing and keep rod close to the sphere

[3]

- (b) Fig. 8.1 shows an electronic component.



Fig. 8.1

State the name of the component shown in Fig. 8.1

Light Emitting Diode [1]
OR LED

- (c) In the space below, write down the truth table for a NAND gate.

INPUT		OUTPUT
A	B	C
0	0	1
0	1	1
1	0	1
1	1	0

[2]

(d) Fig. 8.2 shows the connections to two logic gates.

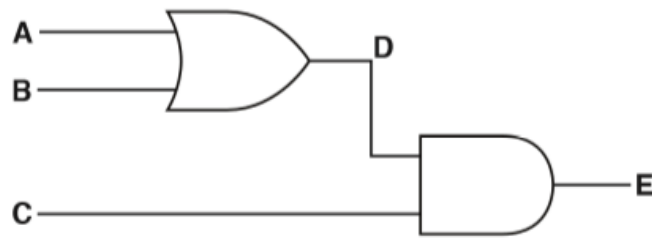


Fig. 8.2

Table 8.1 shows part of the truth table for the arrangement of logic gates in Fig. 8.2.

Complete Table 8.1 for the input values shown.

Table 8.1

inputs			intermediate point	output
A	B	C	D	E
0	0	1	0	0
0	1	1	1	1
1	1	0	1	0
1	1	1	1	1

[3]

[Total: 9]

- 9 (a) Describe how to demagnetise a bar magnet using alternating current (a.c.) in a coil.

Place magnet in the coil and then gradually withdraw it, with the a.c. switched on.

[3]

- (b) Fig. 9.1 shows a simple direct current (d.c.) motor.

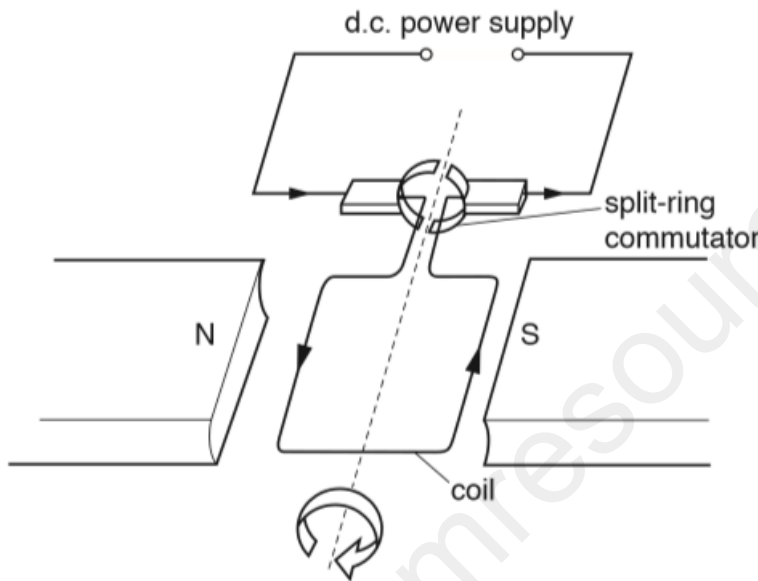


Fig. 9.1

- (i) Explain the purpose of the split-ring commutator.

It keeps the coil rotating in the same direction by changing the direction of the current every half turn (or every 180°).

[3]

- (ii) The voltage of the power supply is increased.

State the effect this has on the motor.

The coil rotates faster.

[1]

[Total: 7]

- 10 Fig. 10.1 shows a circuit containing a filament lamp of resistance $0.30\ \Omega$ and two resistors, each of resistance $0.20\ \Omega$.

Combined Resistance

$$\Rightarrow \frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$\Rightarrow \frac{1}{R} = \frac{R_1 + R_2}{R_1 R_2}$$

$$\Rightarrow R = \frac{[R_1 R_2]}{[R_1 + R_2]}$$

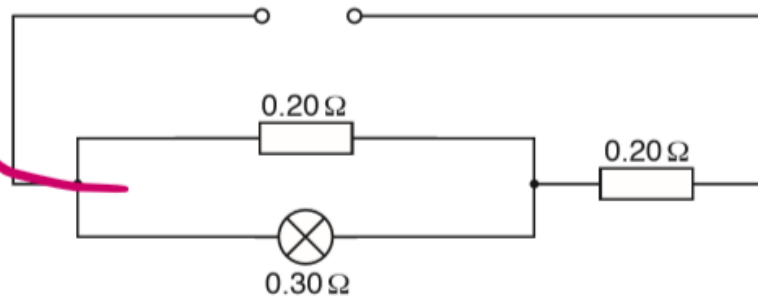


Fig. 10.1

- (a) Calculate the combined resistance of the lamp and the two resistors.

$$\rightarrow R = \frac{0.30 \times 0.20}{0.30 + 0.20} = 0.12\ \Omega$$

\therefore Total Resistance of lamp and resistors

$$= 0.12\ \Omega + 0.20\ \Omega$$

$$= 0.32\ \Omega$$

resistance = $0.32\ \Omega$ [3]

- (b) The potential difference (p.d.) of the supply is increased so that the current in the lamp increases.

State and explain any change in the resistance of the lamp.

Statement **Resistance of lamp increases**

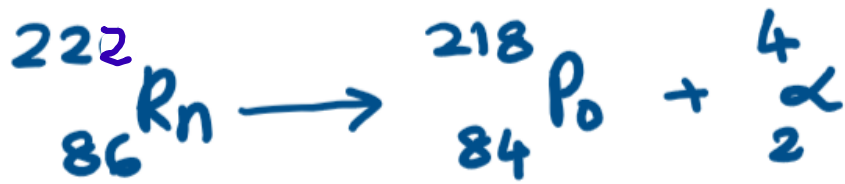
Explanation **Temperature of lamp increases**

[2]

[Total: 5]

- 11 (a) A radon-222 nucleus contains 86 protons and 136 neutrons. It decays by emitting an α -particle and becomes a nucleus of an isotope of polonium. The symbol for radon is Rn and the symbol for polonium is Po.

Write down the nuclide equation for this decay.



[3]

- (b) Carbon-14 is radioactive with a half-life of 5700 years. An animal bone is dug up in an archaeological excavation. The quantity of carbon-14 in the bone is 25% of what it was when the bone was buried.

Calculate the time that has elapsed since it was buried.

Let original mass of animal bone = 100 units
 [25 25 25 25]

In 1st half life this mass is lost
 In 2nd half life 25% remains
 time = 11400 years [2]
 [Total: 5]

This indicates if 25% mass remains, then 2 half lives have elapsed.

5700 + 5700
 1st half life 2nd half life

\therefore Time that has elapsed since bone was buried = 5700 + 5700 = 11400 years

★ Note: Marking scheme says 11000 years ★

www.smartexamresources.com

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.