



BOTSWANA EXAMINATIONS COUNCIL  
Botswana General Certificate of Secondary Education

CANDIDATE  
NAME

CENTRE  
NUMBER

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CANDIDATE  
NUMBER

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**PHYSICS**

**0571/03**

Paper 3

**October/November 2019**

**1 hour 15 minutes**

Candidates answer on the Question Paper.

Additional Materials:    Electronic calculator  
   300 mm ruler

**READ THESE INSTRUCTIONS FIRST**

Write your candidate name, Centre number and candidate number in the spaces provided at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided on the Question Paper.

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

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

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

Take the weight of 1 kg to be 10 N (i.e. acceleration of free fall =  $10 \text{ m/s}^2$ ).

For Examiner's Use	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
<b>TOTAL</b>	

This document consists of **16** printed pages.

[Turn over



1 (a) Define the term *speed*.

.....  
..... [1]

(b) Fig. 1.1 shows a distance-time graph of a truck. The graph is not drawn to scale.

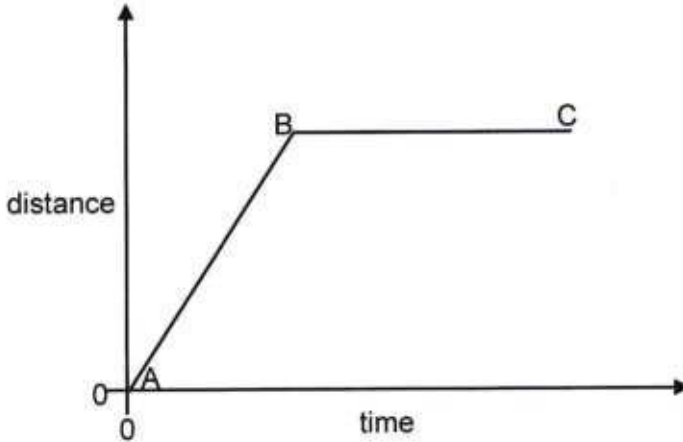


Fig. 1.1

Describe the motion of the truck between points AB and BC.

AB.....  
BC..... [2]

(c) Fig. 1.2 shows a truck of length 20 m passing a lamp post with the front end in line with the lamp post. The truck is approaching a stop sign. The truck is moving at a constant speed. The truck takes 2.0 s to pass the lamp post.

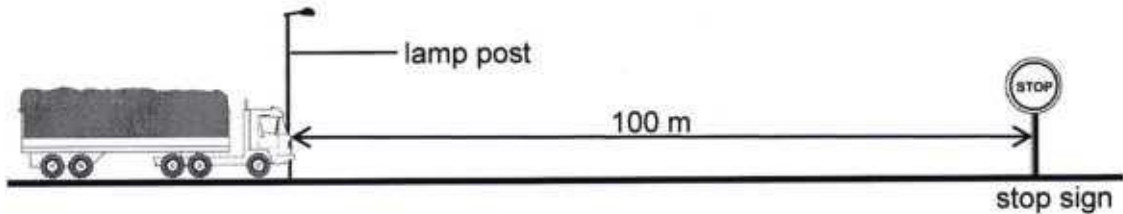


Fig. 1.2

(i) Calculate the speed of the truck.

speed = ..... [2]

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- (ii) The truck starts to decelerate uniformly when its tail end is in-line with the lamp post. The truck stops when its front end is in-line with the stop sign. The distance between the stop sign and the lamp post is 100 m.

Determine the time taken by the truck when decelerating.

time = ..... [2]

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2 (a) State the principle of moments.

.....  
 ..... [1]

(b) Fig. 2.1 shows a wheel barrow. The weight  $W$  of the wheelbarrow is 300 N. Force  $F$  is used to support the wheel barrow when its leg supports are off the ground.

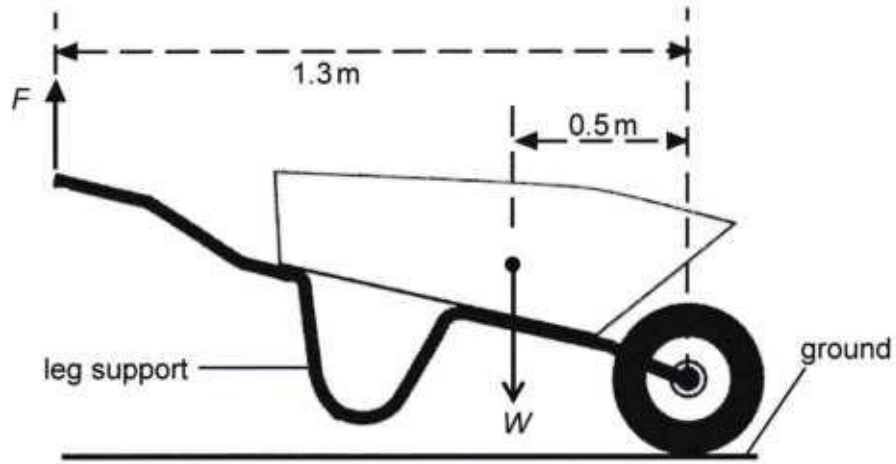


Fig. 2.1

Calculate the force  $F$ .

$F = \dots\dots\dots$  [2]

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(c) Fig. 2.2 shows the wheel barrow in Fig. 2.1 now with its leg supports resting on the ground.

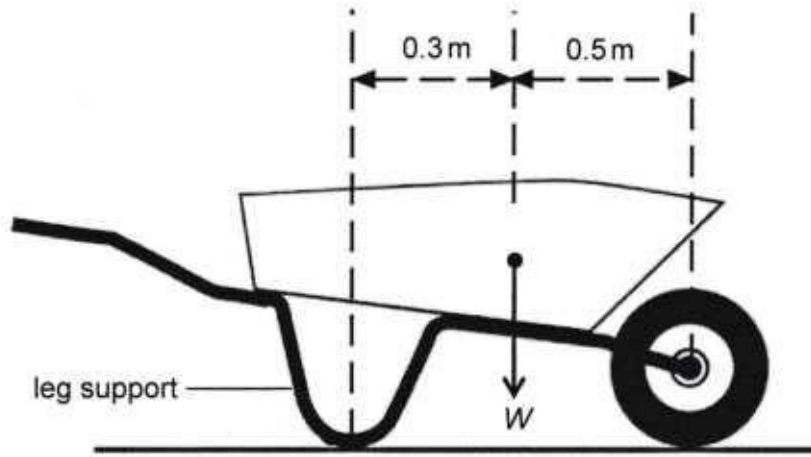


Fig. 2.2

Calculate the force exerted on the ground by:

(i) the wheel,

force = ..... [2]

(ii) the leg supports.

force = ..... [1]

- 3 (a) A pond has ice at the surface and cold water at the bottom.

Name the process by which cold water near the ice sinks.

..... [1]

- (b) Define *specific latent heat of fusion*.

.....

..... [1]

- (c) A bucket contains 5.0 kg of ice at 0 °C. Water at 27 °C is poured into the ice. The ice completely melts and the final temperature of the mixture is 0 °C.

Calculate:

- (i) the thermal energy needed to melt the ice,  
The specific latent heat of fusion of ice is 330 000 J/kg.

thermal energy = ..... [2]

- (ii) the mass of the water poured into the ice.  
The specific heat capacity of water is 4200 J/kg °C.

mass = ..... [2]



4 Fig. 4.1 shows a syringe containing  $6.0 \text{ cm}^3$  of air. The syringe is sealed at one end.

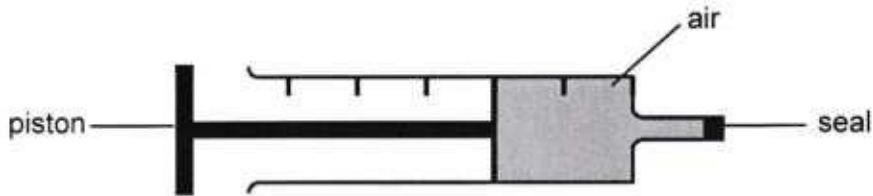


Fig. 4.1

(a) The air exerts a pressure of  $1.0 \times 10^5 \text{ Pa}$  on the walls of the syringe.

(i) Describe how air molecules exert pressure on the walls of the syringe.

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

(ii) The piston is pushed to reduce the volume of the air to  $4.0 \text{ cm}^3$ .

Calculate the pressure exerted by the air on the walls of the syringe.

pressure = ..... [2]

(b) The syringe in Fig. 4.1 is placed in warm water and the volume of air increases.

Explain how the molecules are able to create the same pressure with a larger volume.

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



5 (a) State what type of a wave is sound?

..... [1]

(b) (i) What is ultrasonic sound?

.....  
..... [1]

(ii) State **one** use of ultrasonic sound.

..... [1]

(c) Fig. 5.1 shows a waveform of a sound from a signal generator displayed on a cathode ray oscilloscope (c.r.o.).

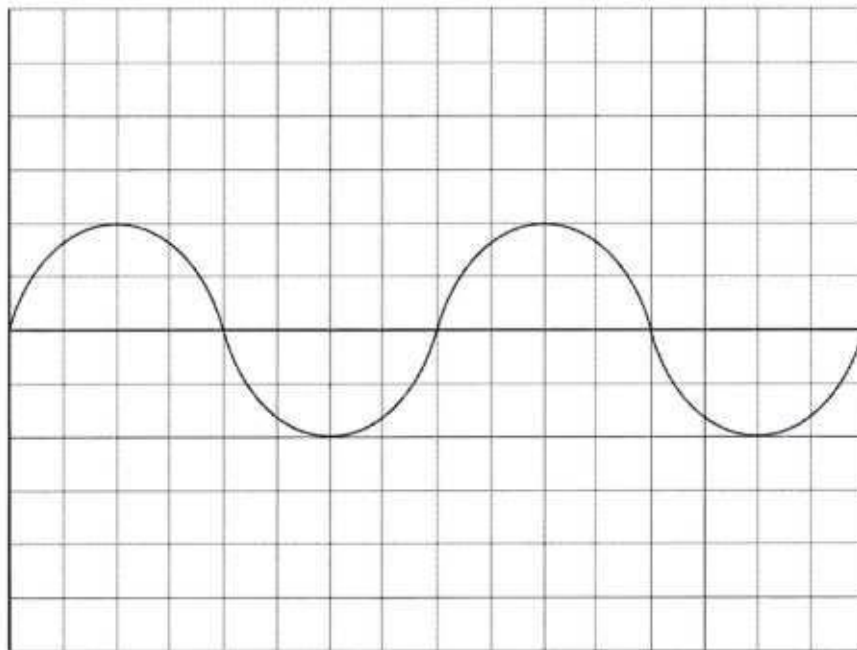


Fig. 5.1

The controls on the c.r.o. are not changed.

The signal is adjusted to produce a sound with the same pitch but twice the amplitude.

On Fig. 5.1, draw the waveform of the new sound. [2]

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6 (a) State the **two** laws of reflection.

1.....

.....

2.....

.....

[2]

(b) Fig. 6.1 shows rays of light coming from a lamp at the bottom of a pond.

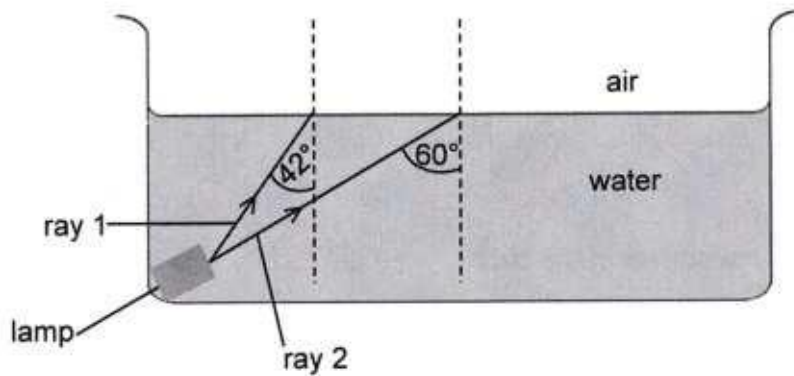


Fig. 6.1 (not to scale)

The critical angle of water is 49°.

State and explain what happens to each ray in Fig. 6.1 when it reaches the surface of the water.

ray 1.....

explanation.....

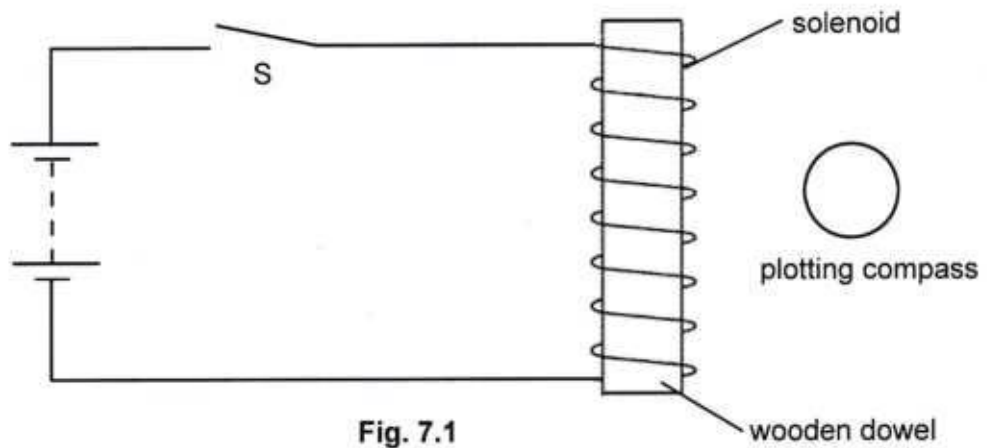
ray 2.....

explanation.....

[4]



- 7 Fig. 7.1 shows an electric circuit. A plotting compass is placed next to the solenoid.



The switch S is closed.

- (a) On Fig. 7.1, draw:

- (i) the direction of the current in the circuit, [1]  
 (ii) the plotting compass needle to show the direction of the magnetic field. [1]

- (b) State **two** ways of increasing the strength of an electromagnet.

1.....

2.....

[2]

(c) Fig. 7.2 shows another circuit placed near the circuit in Fig. 7.1.

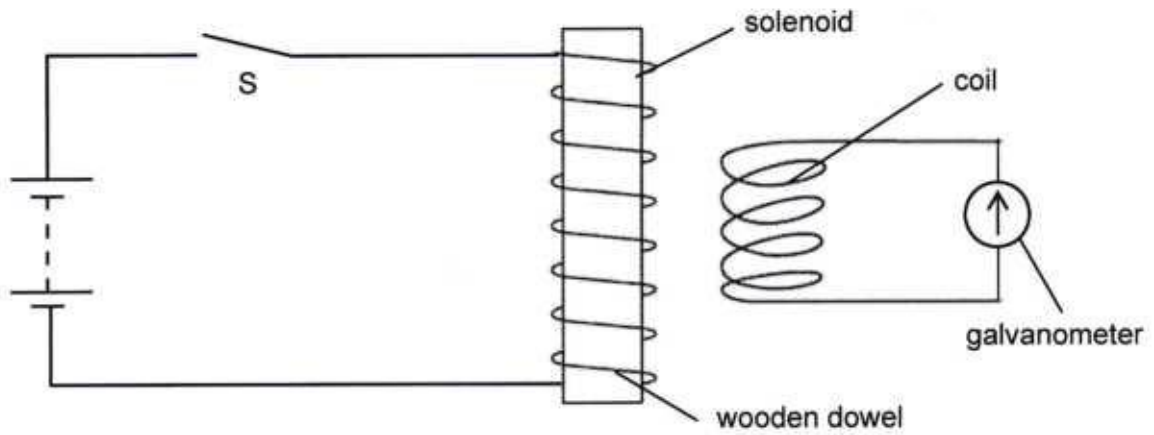


Fig. 7.2

State and explain what is observed when the switch S is closed.

observation.....[1]

explanation.....

.....

.....

.....

.....[3]

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- 8 Fig. 8.1 shows a large, positively charged conducting sphere supported by an insulating stand. The sphere has a large number of positive charges. The sphere is placed between two small conducting balls A and B, suspended using insulating threads.

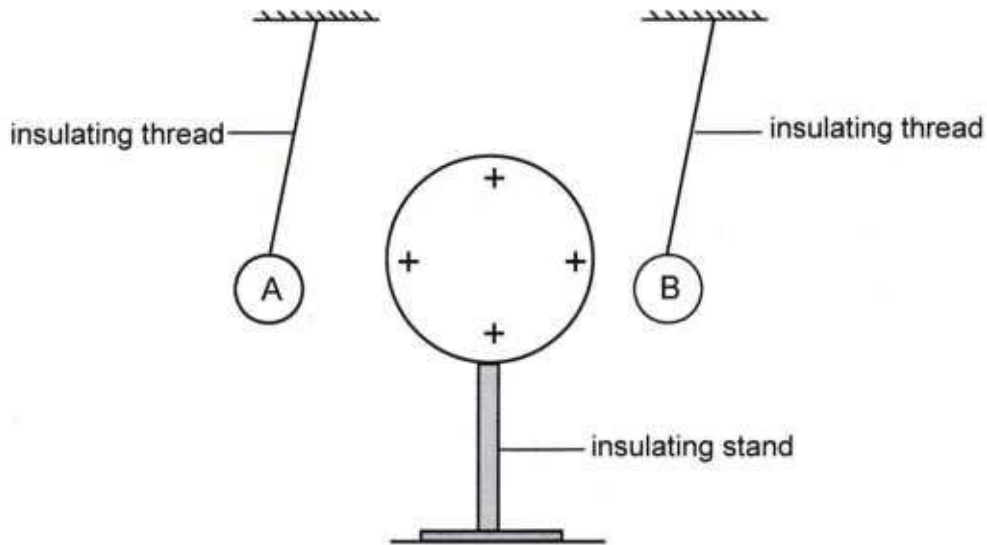


Fig. 8.1

- (a) The sphere is moved towards ball A. Ball A moves away from the sphere.

State the charge on ball A.

..... [1]

- (b) (i) The sphere is moved towards ball B. Ball B touches the sphere and moves away.

Suggest the charge on ball B before it touches the sphere.

..... [1]

- (ii) Explain why ball B moves away from the sphere after touching it.

.....

..... [1]

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(c) Fig. 8.2 shows a gold leaf electroscope.

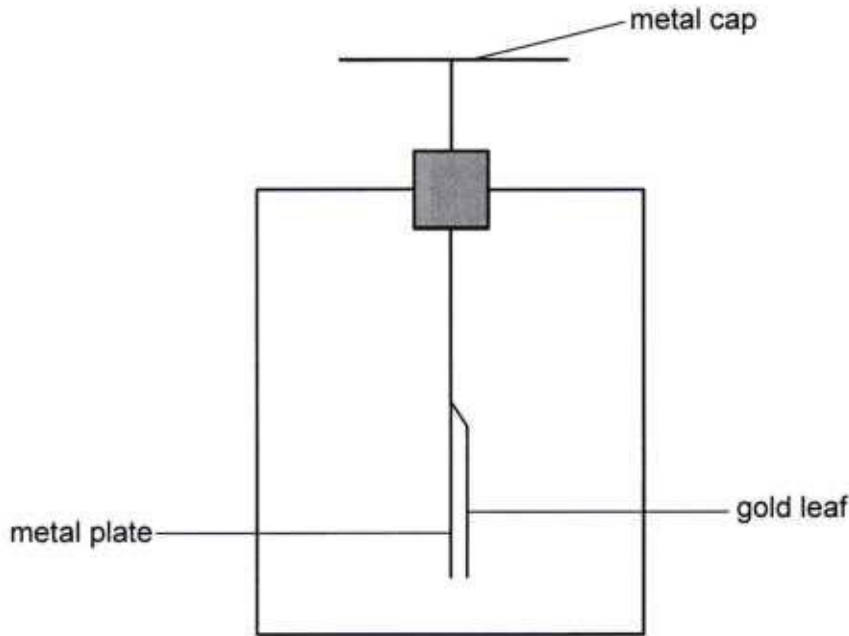


Fig. 8.2

A positively charged rod is placed above, but not touching, the metal cap of the electroscope.

State and explain what is observed.

observation.....

explanation.....

.....

.....

[3]

9 Fig. 9.1 shows an electric circuit.

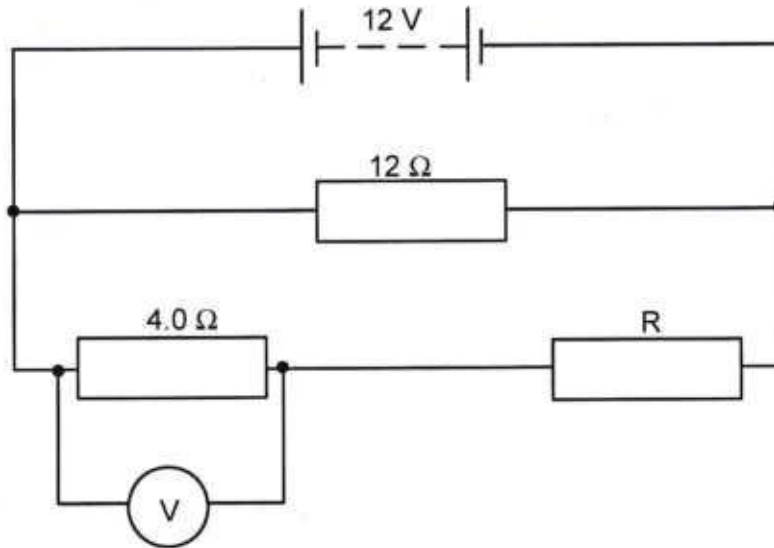


Fig. 9.1

The voltmeter reading is 8.0V.

Calculate:

(a) the potential difference across R,

potential difference = ..... [1]

(b) the total current in the circuit,

current = ..... [2]

(c) the value of resistor R,

R = ..... [2]

(d) the power dissipated in the 4.0Ω resistor.

power = ..... [2]

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10 Fig. 10.1 shows the circuit of an electric fire. The electric fire is connected to a 240 V mains.

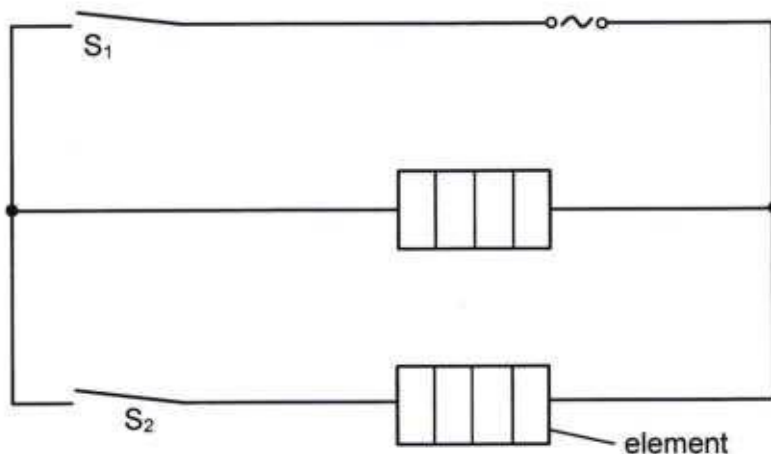


Fig. 10.1

The electric fire has two identical elements, each rated 1000 W.

(a) Which component of the electromagnetic spectrum is emitted by the electric fire?

..... [1]

(b) Switch  $S_1$  is closed for 3 hours.

Calculate the charge that flows through the electric fire.

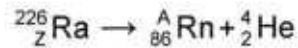
charge = ..... [3]

(c) Switches  $S_1$  and  $S_2$  are closed for 3 hours. Electricity is charged at P0.80 per kWh.

Calculate the cost of using the electric fire for 3 hours.

cost = ..... [2]

11 Radium-226 decays by emitting an alpha particle to form radon Rn, as shown by the equation.



(a) (i) State the charge of an alpha particle.

..... [1]

(ii) State the values of Z and A in the equation.

Z = .....

A = .....

[2]

(b) The half-life of radium-226 is 1600 years.

Determine the number of years taken for a sample of radium-226 to decay until only one eighth of the original radium-226 remains.

years = ..... [2]

(c) Suggest **two** reasons why radium-226 is **not** suitable to use as a tracer for medical purposes.

1.....

2.....

[2]

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