



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 2013**

**1 hour 15 minutes**

Candidates answer on the Question Paper.

Additional Materials:    Electronic calculator  
   300 mm ruler



**READ THESE INSTRUCTIONS FIRST**

- Write your Centre number, candidate number and name 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 10N (i.e. acceleration of free fall =  $10 \text{ m/s}^2$ ).

<b>For Examiner's Use</b>

- 1 Fig. 1.1 shows a stop watch used to record the time taken by an athlete to run a 100 m race.

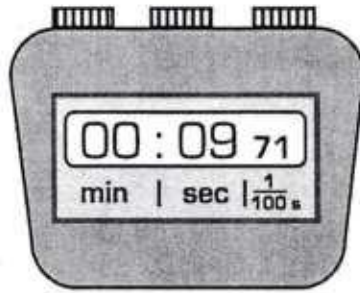


Fig. 1.1

- (a) Write down the time recorded by the stopwatch.

time ..... [1]

- (b) Calculate the average speed of the athlete.

average speed ..... [2]

- (c) State **one** possible source of error when using a stopwatch.

..... [1]

- 2 A man fires a bullet vertically upwards from a toy gun that is 1.25 m above the ground as shown in Fig. 2.1. The bullet leaves the gun at a speed of 10 m/s and takes 1.0 s to reach maximum height. ( $g = 10 \text{ m/s}^2$ )

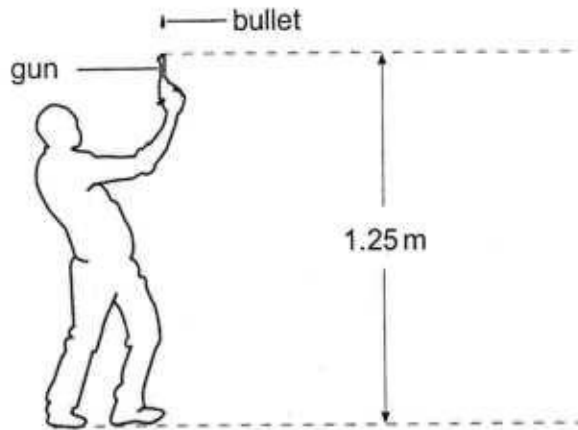


Fig.2.1

- (a) What is the speed of the bullet at the maximum height?

speed = ..... [1]

- (b) Neglecting air resistance, calculate

- (i) the maximum height reached by the bullet from the gun,

height = ..... [2]

- (ii) the velocity with which the bullet strikes the ground when it comes back.

velocity = ..... [3]

- (c) State the energy change that occurs as the bullet moves up.

..... [1]

- 3 Fig. 3.1 shows a 2000 W electric kettle connected to the mains being used to boil some water. The kettle is placed on an electronic balance and the balance reads 350.0 g.

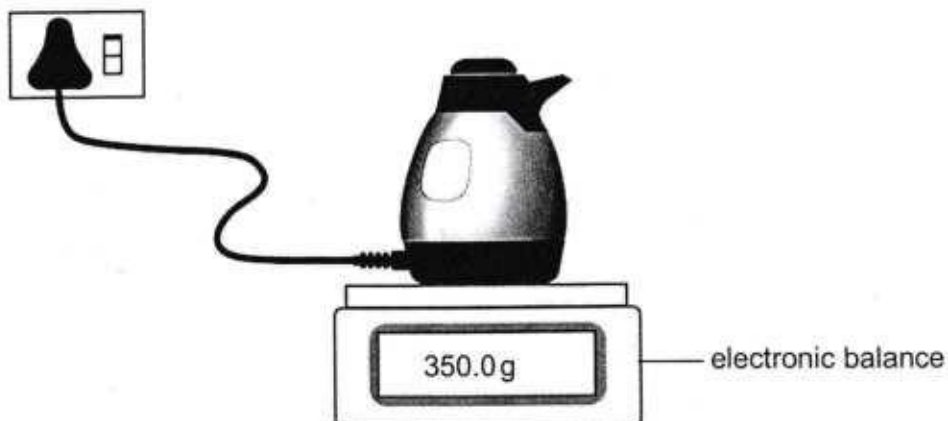


Fig. 3.1

- (a) The specific latent heat of vaporisation of water is 336 J/g.

Explain the meaning of this statement.

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

- (b) After boiling the water for a while, the balance displays a reading of 330.0 g.

Determine

- (i) the mass of the water vaporised,

mass = ..... [1]

- (ii) the amount of heat energy used to vaporise the water,

heat energy = ..... [2]

- (iii) the time taken to vaporise the water.

time = ..... [2]

- 4 Fig. 4.1 shows an uncalibrated mercury thermometer with two fixed points **A** and **B** marked on it. The fixed points are to be determined using pure water.

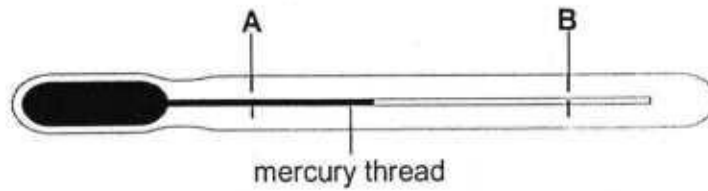


Fig. 4.1

- (a) What are the temperature values of point **A** and point **B**?

point **A** = .....

point **B** = ..... [2]

- (b) Describe an experiment to show that point **A** has been marked correctly.

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

- (c) The distance between points **A** and **B** is 25 cm.

Determine the temperature reading if the mercury thread stops 15 cm from point **A**.

temperature reading ..... [2]

5 (a) State **two** laws of reflection.

1 .....

.....

2 .....

..... [2]

(b) Fig. 5.1 shows an object, **O**, placed in front of a plane mirror.

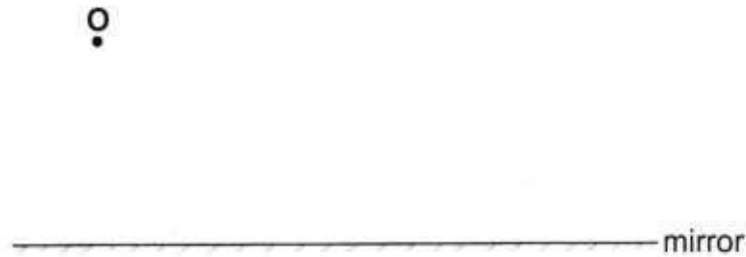


Fig. 5.1

Complete Fig. 5.1, by drawing suitable rays, to show how the image of **O** is formed.  
Label the image **I**.

[3]

(c) State **two** characteristics of the image formed by the plane mirror.

1 .....

2 .....

[2]

- 6 Fig. 6.1 shows the position of a man playing a drum and the position of an observer in front of a wall. The observer is 150 m from the man with a drum and 450 m from the wall.

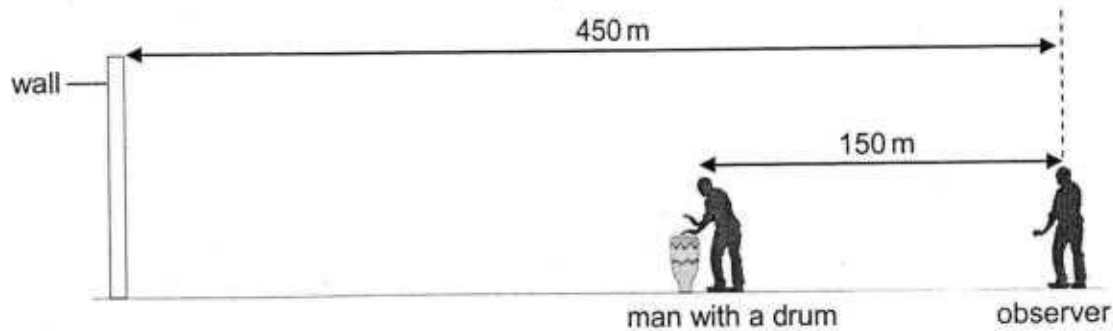


Fig. 6.1

When the drummer hits the drum once, the observer hears two similar sounds, one after the other.

- (a) (i) Explain why the observer hears the two sounds.

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

- (ii) The speed of the sound waves in air is 320 m/s.

Calculate the time interval between the two sounds heard by the observer.

time interval = ..... [3]

- (b) The drum vibrates at a frequency of 500 Hz.

State the frequency of the sound waves reaching the observer.

frequency = ..... [1]

7 Fig. 7.1 shows a positively charged electroscope.

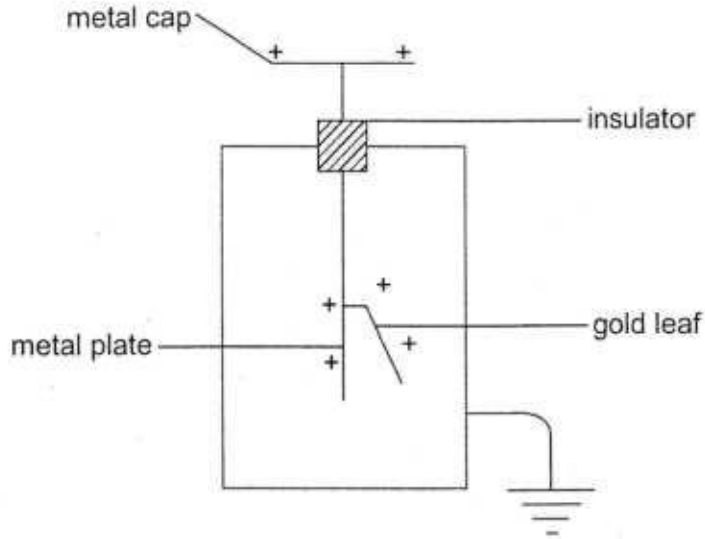


Fig. 7.1

(a) State and explain what is observed when a positively charged rod is brought near the metal cap of the electroscope.

observation .....

explanation .....

..... [2]

(b) The positively charged rod is removed and the metal cap of the electroscope is touched with a finger. State and explain what is observed.

observation .....

explanation .....

..... [2]

- 8 Fig. 8.1 shows an electric circuit.

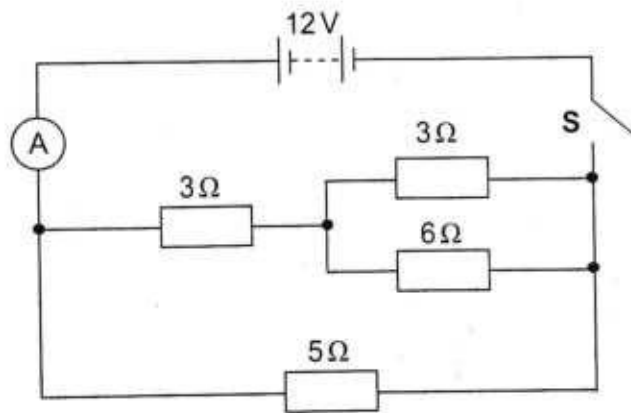


Fig. 8.1

Calculate

- (a) the total resistance of the circuit,

resistance = ..... [2]

- (b) the current through the ammeter when switch **S** is closed,

current = ..... [2]

- (c) the power dissipated in the 5 Ω resistor.

power = ..... [2]

9 Fig. 9.1 shows a simple alternating current generator used to light a lamp.

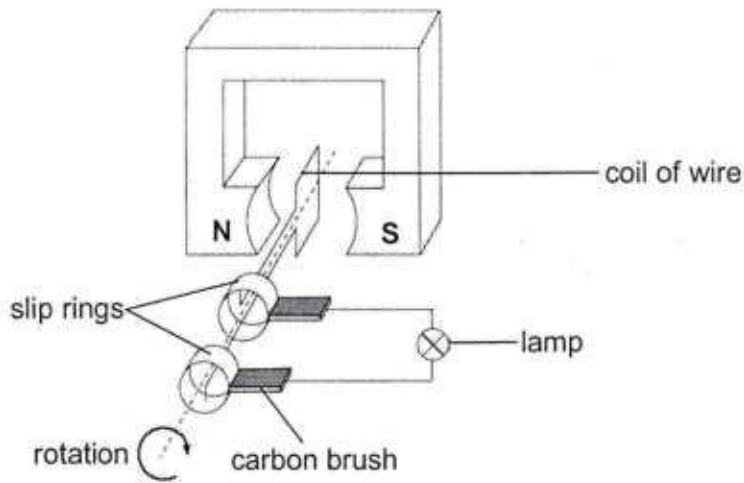


Fig. 9.1

(a) When the coil rotates slowly, the lamp lights but the brightness keeps changing.

(i) Explain how the generator produces current to light the lamp.

.....

.....

.....

..... [2]

(ii) Explain why the brightness of the lamp changes.

.....

..... [1]

(b) State **two** changes that can be made to make the lamp brighter.

1 .....

2 ..... [2]

10 Fig. 10.1 shows a reed relay used to switch on an electric motor, M.

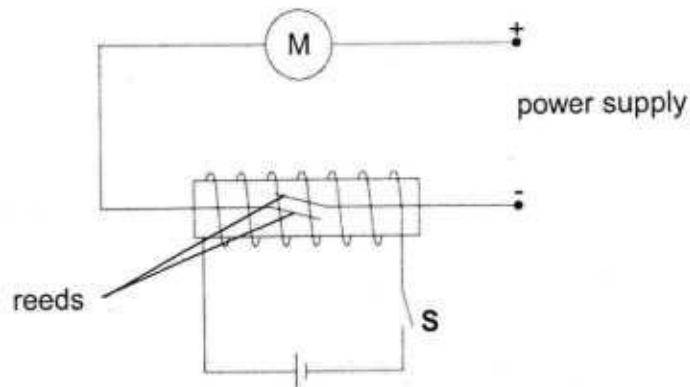


Fig. 10.1

(a) Explain what happens when switch S is closed.

.....

.....

.....

.....

.....

..... [4]

(b) (i) Name a suitable material for making the reeds.

.....

(ii) Explain your answer to (b)(i).

.....

..... [2]

11 Fig. 11.1 shows the structure of a cathode-ray oscilloscope.

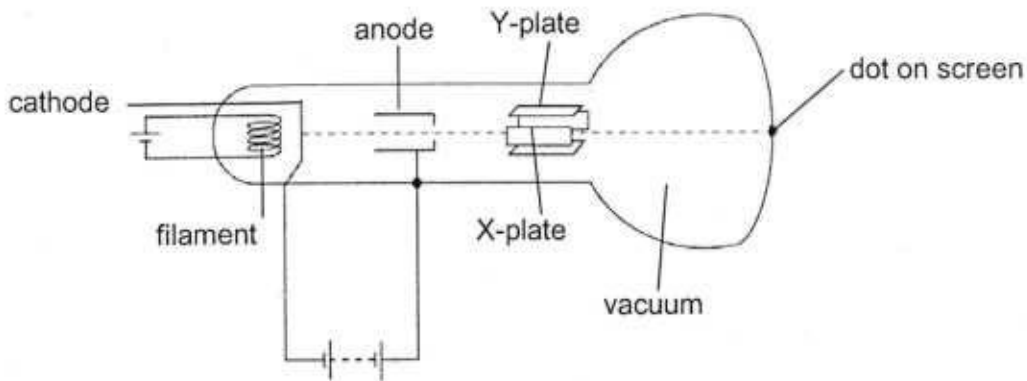


Fig. 11.1

(a) Explain why the cathode emits electrons.

..... [1]

(b) Explain why the electrons accelerate towards the anode.

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

(c) When a potential difference of 80 V is supplied across the Y plates, the dot on the screen is deflected by 12 mm.

Calculate the deflection that is produced on the dot when the potential difference across the Y plates is increased to 240 V.

deflection = ..... [2]

(d) Explain why the space inside the oscilloscope must be a vacuum.

..... [1]

12 Carbon-14 is a radioactive isotope with a half-life of 6 000 years. An atom of carbon-14 decays by emitting a  $\beta$ -particle.

(a) (i) State the nature of a  $\beta$ -particle.

.....

(ii) Define *half-life*.

.....

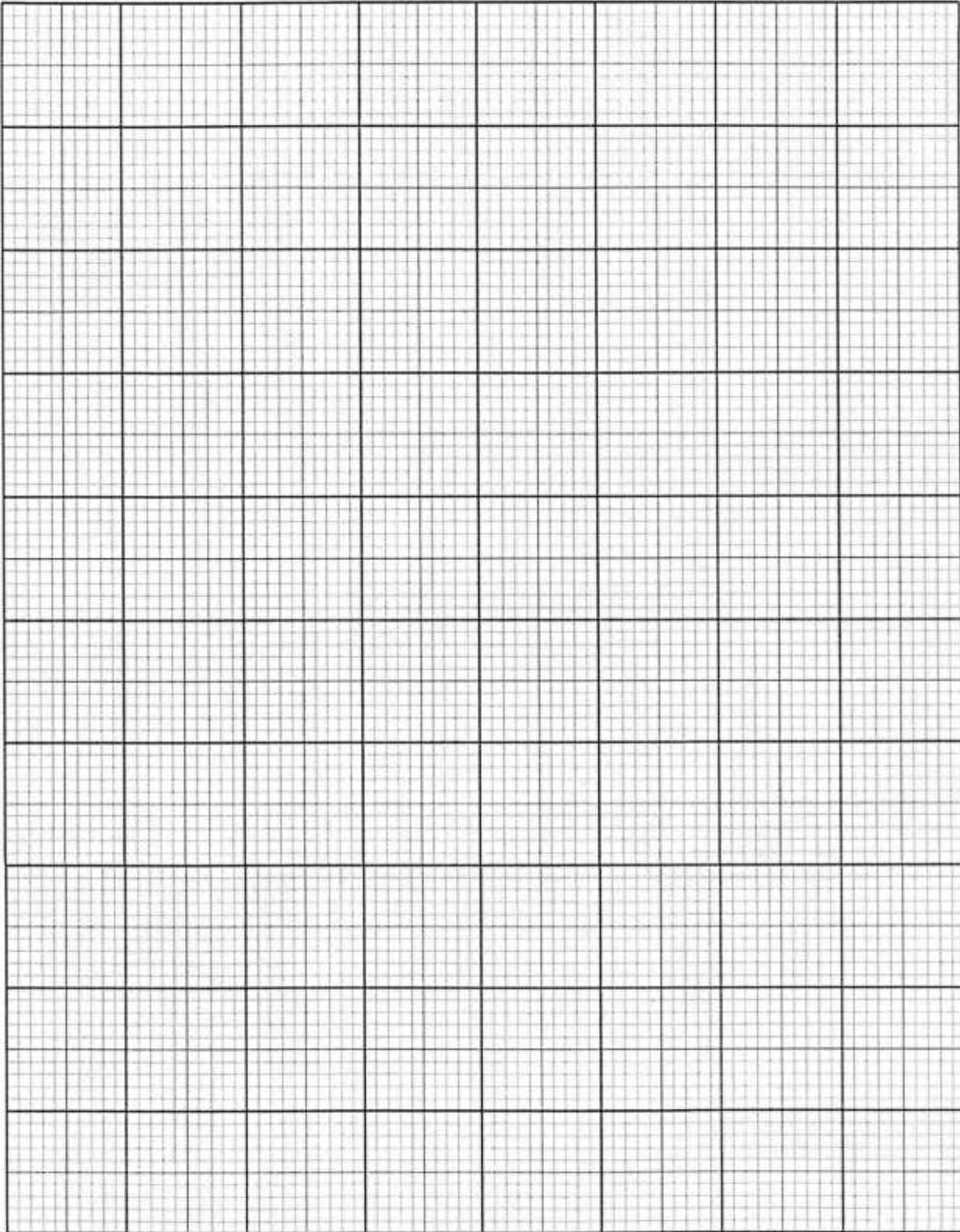
..... [2]

(b) (i) Table 12.1 shows how the number of atoms in a carbon-14 sample changes with time.

Table 12.1

time / years	number of atoms
0	500
3 000	350
6 000	250
12 000	125
15 000	100
18 000	63

On the grid below, plot a graph of the number of atoms against time.



(ii) Use your graph to find the number of atoms when the time is 9 000 years.

[4]

number of atoms = ..... [1]