



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 Theory

October/November 2020

1 hour 15 minutes

You must answer on the Question Paper.

Additional Materials: Electronic calculator
 300 mm ruler

INSTRUCTIONS

- Answer **all** questions.
- Use black or dark blue pen.
- Write your candidate name, Centre number and candidate number in the spaces provided at the top of this 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 barcodes.
- You may use an HB pencil for any diagrams, graphs or rough working.

INFORMATION

- The total mark for this paper is 70.
- The number of marks for each question or part question is shown in brackets [].
- You may lose your marks if you do not show your working.
- Take the weight of 1kg to be 10 N (i.e. acceleration of free fall = 10 m/s^2)

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

This document consists of **14** printed pages and **2** blank pages.

[Turn over



1 A student runs a race and covers the last stage of the race at a constant speed.

(a) Define the term *speed*.

..... [1]

(b) Fig. 1.1 shows the time recorded for the race.

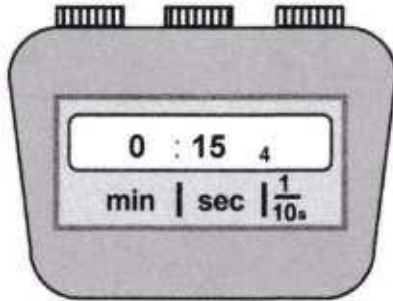


Fig. 1.1

State the time shown by the stopwatch.

time = [1]

(c) State and explain the type of error that occurs when measuring time using a digital stopwatch.

error

explanation

..... [2]

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2 A small aluminium cube has a density of 2700 kg/m^3 .

(a) Define the term *density*.

..... [1]

(b) The cube is placed in water of density 1000 kg/m^3 .

(i) State the name of a single instrument that can measure the density of water.

..... [1]

(ii) State and explain whether the aluminium cube will float or sink in water.

statement

explanation

[1]



- 3 Fig. 3.1 shows a student standing on a uniform plank of length 4.5 m. The plank is pivoted at P and attached to a spring balance that balances it horizontally. Fig. 3.1 is not drawn to scale.

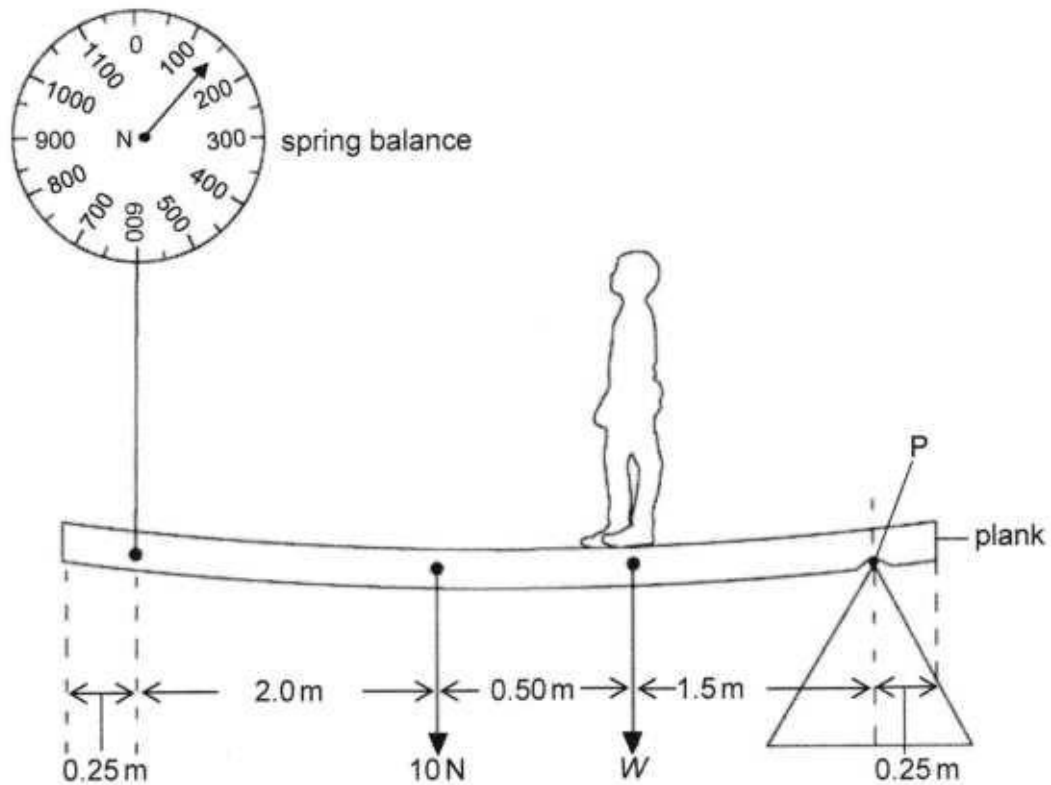


Fig. 3.1

- (a) State the principle of moments.

..... [1]

- (b) State the reading shown on the spring balance.

reading = [1]

- (c) Taking moments about P,

Calculate:

- (i) the moment of the force from the spring balance,

moment = [2]

- (ii) the weight W of the student.

weight = [3]



4 Fig. 4.1 shows a graph of volume against temperature for a sample of water.

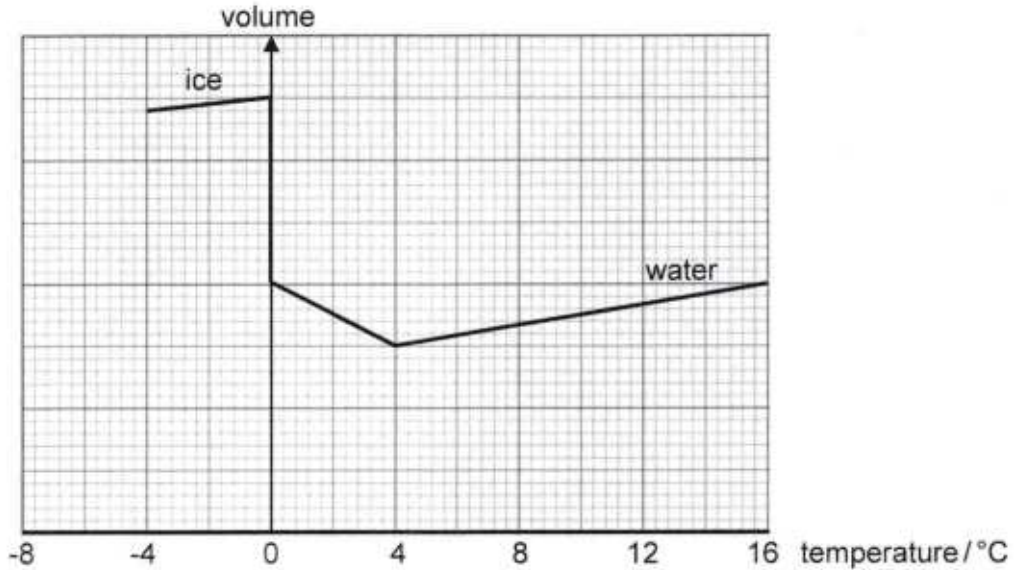


Fig. 4.1

(a) State the temperature at which:

(i) the water has the highest density,

temperature = [1]

(ii) the ice melts.

temperature = [1]

(b) Use the graph to describe how the volume changes when the ice melts.

.....
 [1]

(c) State how thermal energy supplied to the ice is used during melting.

.....
 [1]

(d) The thermal energy absorbed during melting is 1.68×10^6 J.
 The specific latent heat of fusion of ice is 3.36×10^5 J/kg.

Calculate the mass of ice.

mass = [2]

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5 Fig. 5.1 shows a simple car cooling system.

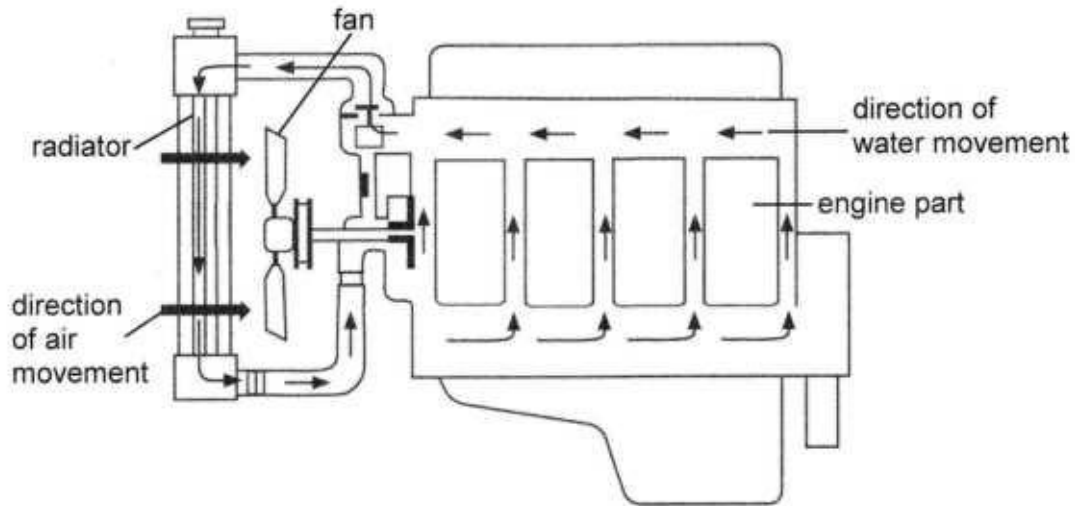


Fig. 5.1

(a) State the name of the main process by which water gains heat from the engine.

..... [1]

(b) Explain how convection currents are formed in the cooling system.

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

(c) Suggest the purpose of the fan in Fig. 5.1.

..... [1]

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- (d) Fig. 5.2 shows the front view of the radiator.
The radiator is painted black and fitted with many fins.

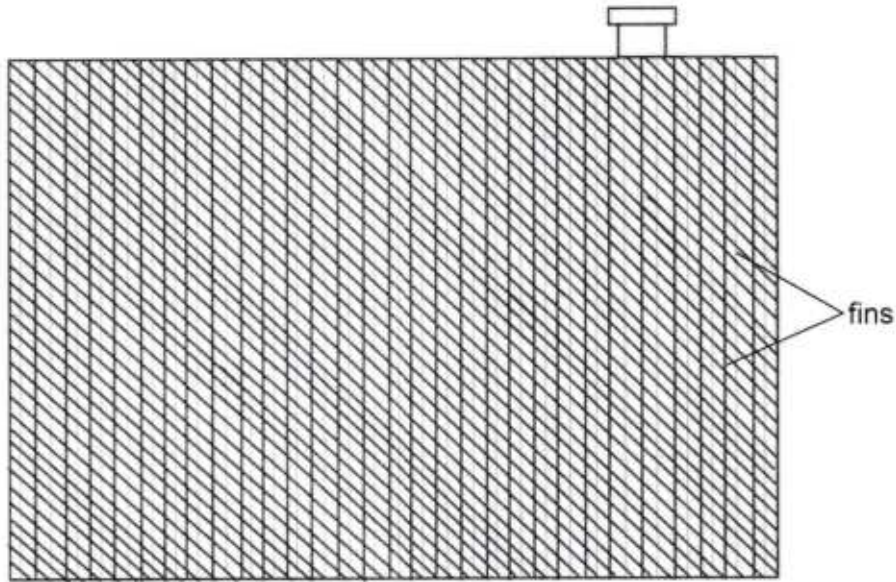


Fig. 5.2

Describe how these features help the radiator to perform its function.

black paint

.....

many fins.....

.....

[2]

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- 6 Fig. 6.1 shows an object O and its virtual image I formed by a thin converging lens.

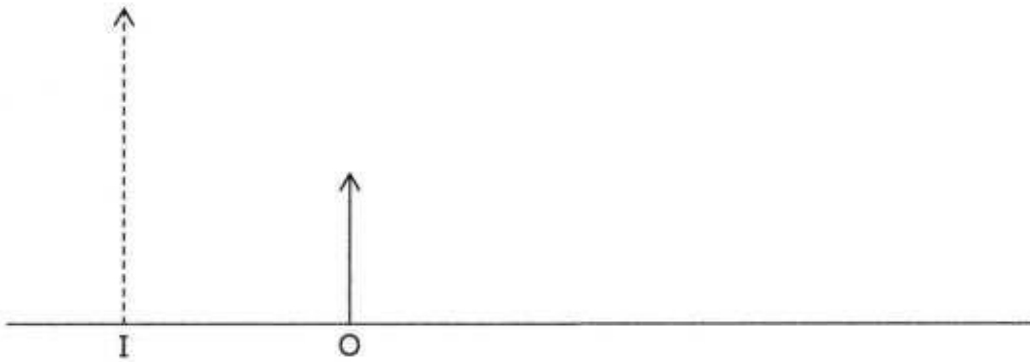


Fig. 6.1

- (a) Define a virtual image.

..... [1]

- (b) State the name of an optical instrument that forms an image as shown in Fig. 6.1.

..... [1]

- (c) On Fig. 6.1,

(i) draw a ray of light to locate the position of the lens and a line to represent the lens. [2]

(ii) draw another ray of light to locate the principal focus. Label it F. [1]

- (d) Determine the magnification of the lens in Fig. 6.1.

magnification = [2]



7 A student stands a distance of 220 m from a wall of a tall building and fires a starter gun. A short time later the student hears an echo of the sound from the gun. The speed of sound in air is 330 m/s.

(a) Define an *echo*.

..... [1]

(b) Calculate:

(i) the distance travelled by the sound for the echo to be heard by the student,

distance = [1]

(ii) the time taken by the sound to travel to and from the wall.

time = [2]

(c) A teacher addresses a group of students in a large hall. The teacher speaks clearly but some of the students hear a distorted sound. These students do not hear clearly what the teacher is saying.

(i) Explain why the students hear distorted sound.

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

(ii) Suggest a simple change to the hall that makes the sound clearer.

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

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8 Fig. 8.1 shows a 2000 W electric kettle used to boil some water.

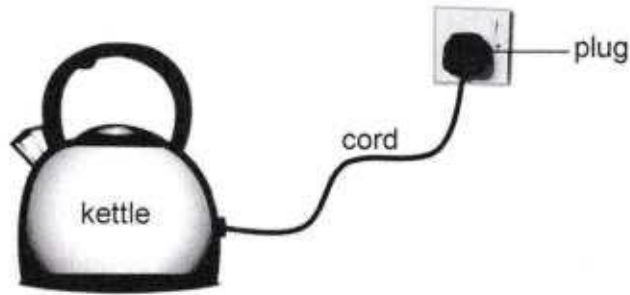


Fig. 8.1

(a) The cord in Fig. 8.1 contains three colour-coded wires connected to the plug.
State the colour of the wire connected to the fuse in the plug.

..... [1]

(b) The body of the kettle is made of metal.

State the name of the wire that is connected to the body of the kettle.

..... [1]

(c) The kettle is connected to a 240 V mains supply.

Calculate the amount of current in the kettle.

current = [2]

(d) The cost of electrical energy used to boil the water in the kettle is P0.10.
1kWh of electrical energy costs P0.60.

Calculate:

(i) the electrical energy in kWh used to boil the water,

energy = [2]

(ii) the time taken to boil the water.

time = [2]

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9 Fig. 9.1 shows two circuits placed next to each other.

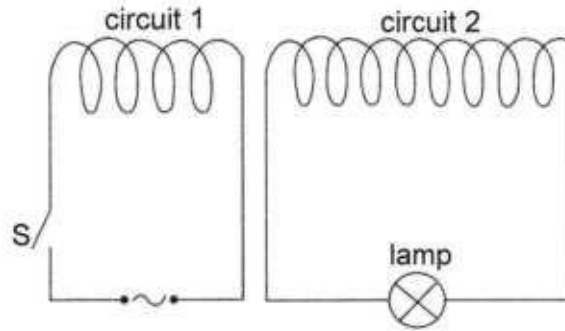


Fig. 9.1

(a) Explain how current is induced in circuit 2 when switch S is closed.

.....

.....

.....

.....

.....

..... [4]

(b) Suggest **two** changes to the circuit to increase the brightness of the lamp in circuit 2.

1

.....

2

..... [2]

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10 Fig. 10.1 shows an electric circuit.

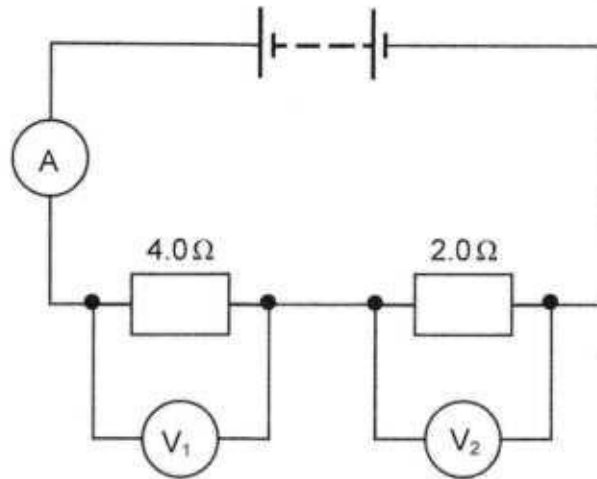


Fig. 10.1

(a) State the purpose of the ammeter in the circuit.

..... [1]

(b) The reading of voltmeter V_1 is 6.0 V.

Determine:

(i) the reading of the ammeter,

ammeter reading = [2]

(ii) the reading of voltmeter V_2 .

voltmeter reading = [1]

(c) Calculate the total resistance in the circuit.

total resistance = [1]

- (d) The 4.0Ω and 2.0Ω resistors are now connected in parallel as shown in Fig. 10.2. The electromotive force of the power supply remains unchanged.

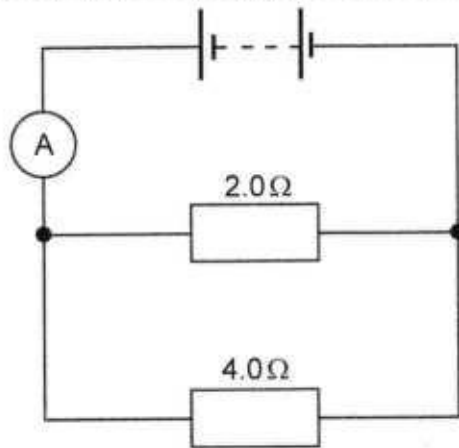


Fig. 10.2

- (i) State and explain the effect that this arrangement of resistors has on the ammeter reading.

effect

explanation

[2]

- (ii) Determine the total resistance of the circuit.

total resistance = [2]

- (e) State **two** factors that affect the resistance of a conductor.

1.....

2.....

[2]

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11 (a) Define *isotopes*.

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

(b) State **two** uses of radioactive isotopes.

1
2 [2]

(c) State the name of a radioactive emission that is a component of the electromagnetic spectrum.

..... [1]

(d) A radioactive emission passes through a magnetic field and is deflected as shown in Fig. 11.1. The magnetic field is into the plane of the paper.

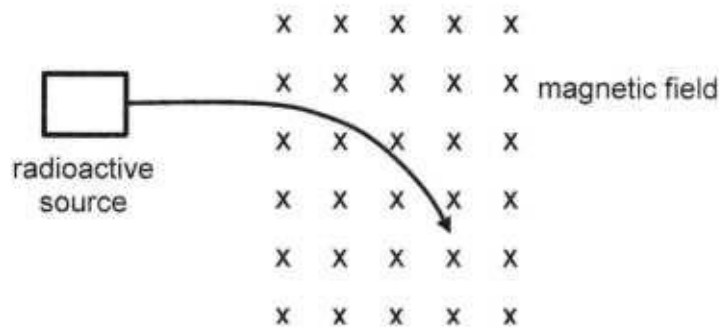


Fig. 11.1

(i) State the name of the emission in Fig. 11.1.

..... [1]

(ii) Suggest a reason why the path of the emission is curved.

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

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