BOTSWANA EXAMINATIONS COUNCIL
Botswana General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

PHYSICS **0571/03**

Paper 3 Theory **October/November 2022**

1 hour 15 minutes

You must answer on the Question Paper.

Additional Materials: Electronic calculator

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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 IN 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 1 kg 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	

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This document consists of **12** printed pages.

[Turn over

For Examiner's Use

1 **(a)** State **one** effect of a force on the motion of an object.

..... [1]

(b) Fig. 1.1 shows a car travelling on a straight level road.
The diagram is not drawn to scale.

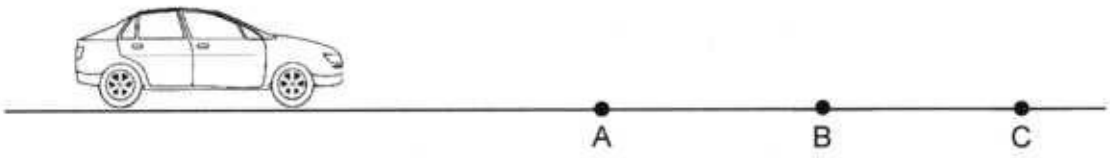
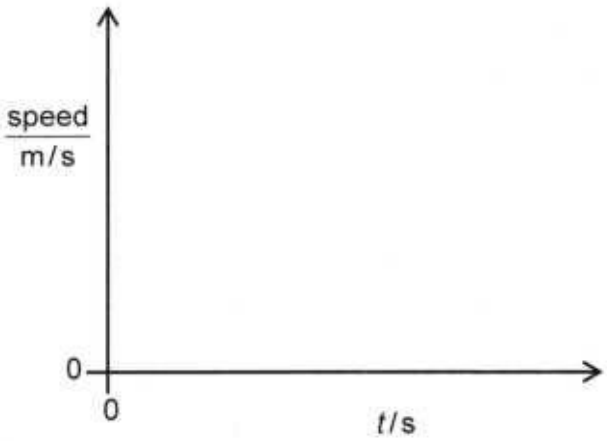


Fig. 1.1

The car travels at a constant speed from point A to B then accelerates uniformly from point B to C.

(i) Sketch a speed-time graph to show the motion of the car from A to C.
Label points A, B and C on the graph.



[2]

(ii) It takes the car 6.0 s to travel from A to B.
At point B the speed of the car is 15 m/s.

Calculate the distance between A and B.

distance ..... [2]

(c) State how the forward force and backward force acting on the car compare between points AB and BC.

AB .....

BC .....

[2]

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2 Fig. 2.1 shows forces F_1 and F_2 acting on an object and their resultant force.
The magnitude of F_1 is 600 N and the magnitude of the resultant force is 1250 N.
The diagram is not drawn to scale.

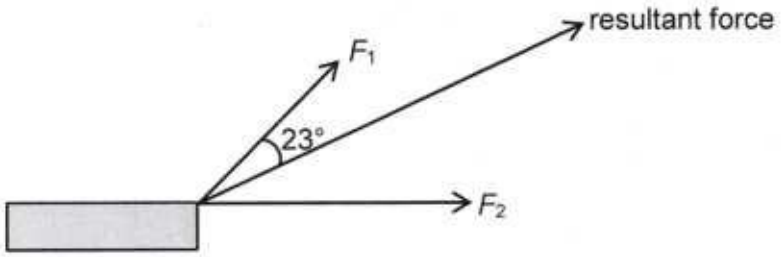

Fig. 2.1

(a) Draw a vector diagram to determine the magnitude of force F_2. Use a suitable scale.

scale used = ...

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F_2 = ...
[4]

(b) Determine the angle between F_1 and F_2.

angle = ... [1]

(c) Suggest how the magnitude of the resultant force can be increased without increasing forces F_1 and F_2.

..... [1]

For Examiner's Use

3 **(a)** Describe *Brownian motion*.

.....

..... [1]

(b) Fig. 3.1 shows a sealed syringe with a fixed mass of a gas.

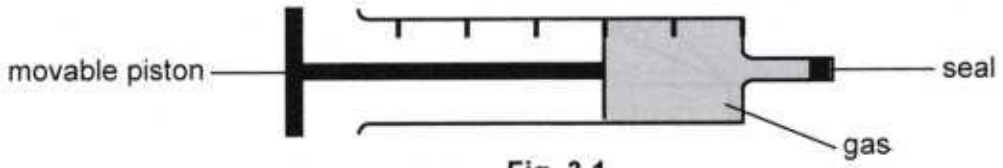

Fig. 3.1

The volume of the gas is 24.0 cm^3.
The atmospheric pressure is 1.00×10^5 Pa.

(i) Describe how the gas exerts pressure on the walls of the syringe.

.....

.....

..... [2]

(ii) The atmospheric pressure is increased to 1.30×10^5 Pa.

Calculate the volume of the gas.

volume = ... [2]

(c) State the assumption made when answering **(b)(ii)**.

.....

..... [1]

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4 Fig. 4.1(a) shows a cross-section for a model of a solar panel that is used to heat water.

Fig. 4.1(b) shows the same solar panel viewed from the top.

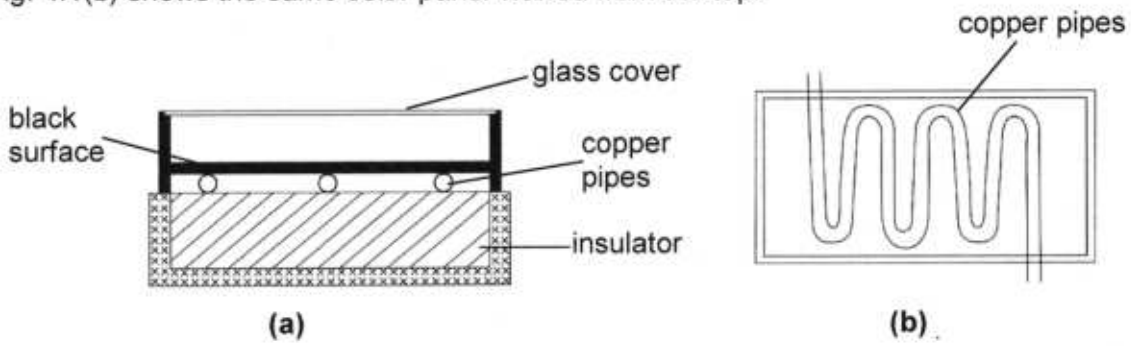

Fig. 4.1

(a) Describe how the heat from outside reaches the water in the copper pipes.

.....

.....

..... [2]

(b) State the main function of the glass cover.

..... [1]

(c) Explain why the copper pipes are coiled inside the panel.

.....

..... [2]

(d) The solar panel heats up 50 kg of water from a temperature of 25 °C to 52 °C in 6.0 hours.

Calculate the rate at which energy is transferred in heating up the water if the solar panel is working optimally. The specific heat capacity of water is 4200 J/(kg °C).

rate of energy transfer = ... [2]

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5 **(a)** Describe a longitudinal wave.

.....

..... [1]

(b) Fig. 5.1 shows a displacement-distance graph of a water wave in shallow water.

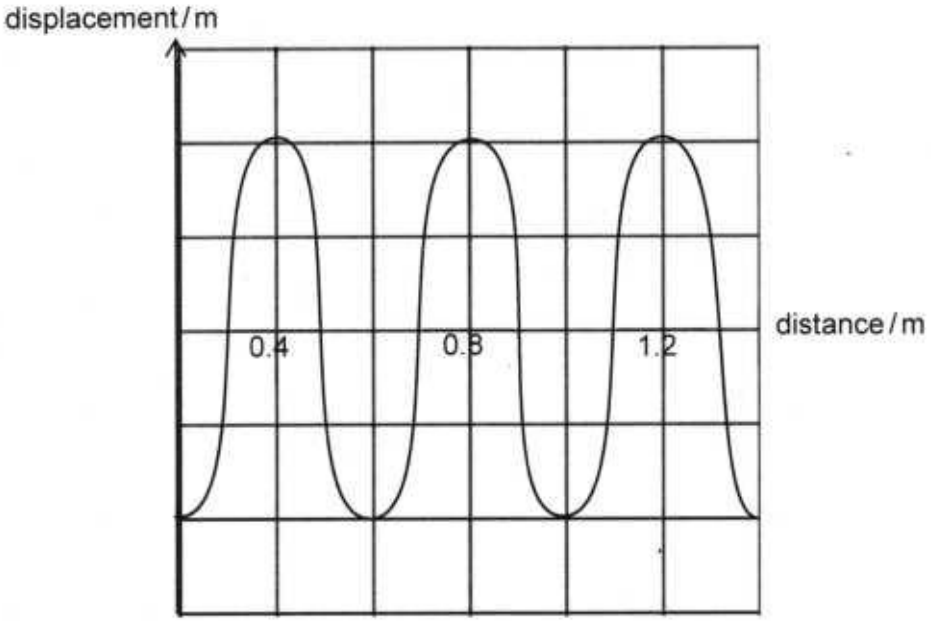

Fig. 5.1

(i) Determine the wavelength of the wave.

wavelength = ... [1]

(ii) The period of the wave is 5.0 s.

Calculate the speed of the wave.

speed = ... [2]

(iii) The water wave travels from shallow water into deep water.

On Fig. 5.1, draw the waveform that represents the water wave in deep water.
Draw **two** complete waves. [2]

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6 **(a)** State how air particles vibrate when a sound wave moves through air.

..... [1]

(b) A bat emits an ultra-sonic sound wave and receives an echo from a wall 0.060 s later.

The speed of sound in air is 330 m / s.

Calculate the distance of the wall from the bat.

distance = ... [2]

(c) Another sound travels the same distance in water to the wall and again creates an echo.

Suggest how the time taken for the echo compares with the value 0.060s in air.
Give reason for your answer.

suggestion .....

reason .....

.....

[2]

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For Examiner's Use

7 Fig. 7.1 shows an electric circuit.

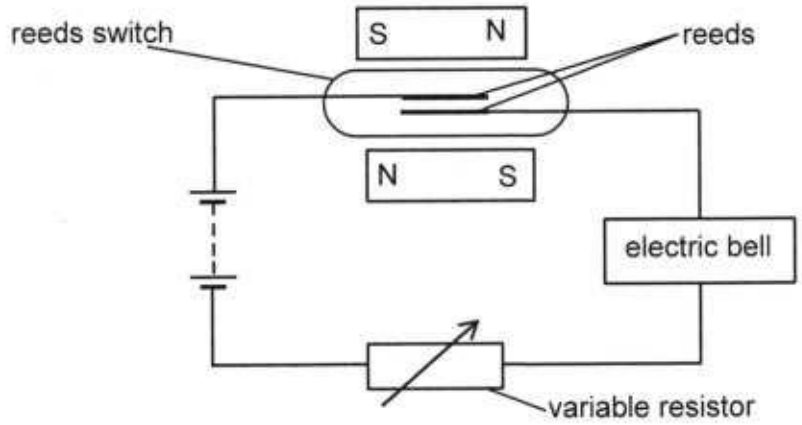

Fig. 7.1

Bar magnets of equal strengths are placed on each side of the reed switch.

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(a) State the name of the metal used to make the reeds.

..... [1]

(b) State and explain the observation that is made.

observation .....

.....

explanation .....

.....

[2]

(c) One of the bar magnets is removed.

State and explain the observation that is made.

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observation .....

.....

explanation .....

.....

[2]

(d) State the main use of the variable resistor in the circuit.

..... [1]

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8 Fig. 8.1 shows two metal plates W and Z supported on insulators and fixed next to each other. Metal plate W has a large amount of positive charge and metal Z is neutral.

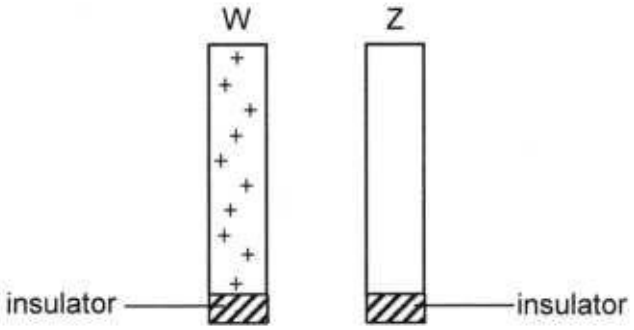

Fig. 8.1

(a) Draw the charge distribution on metal plate Z. [2]

(b) Fig. 8.2 shows the same metal plates with plate Z earthed.

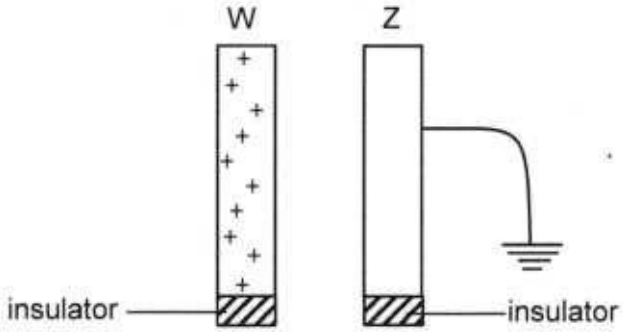

Fig. 8.2

Draw the charge distribution on plate Z. [1]

(c) The earth is removed from Z and the distance between the plates is decreased.

(i) State the likely observation.

..... [1]

(ii) Explain the observation made.

.....

..... [2]

(d) State **one** practical experience similar to the observation in **(c)**.

..... [1]

For Examiner's Use

9 **(a)** Fig. 9.1 shows an electric circuit.

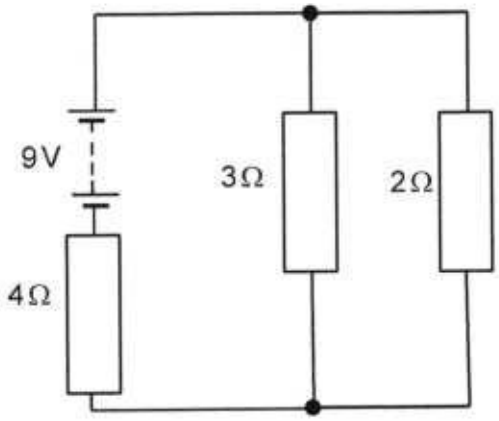

Fig. 9. 1

Calculate:

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(i) the total resistance in the circuit,

total resistance = ... [2]

(ii) the current produced by the power source.

current = ... [2]

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(b) Determine the voltage across 3 Ω resistor.

voltage = ... [2]

(c) The circuit is switched on for 180 s.

Calculate the energy transferred by the power source.

energy = ... [2]

For Examiner's Use

10 (a) State the function of a diode.

..... [1]

(b) Fig. 10.1 shows a set-up used to operate a direct current motor from the mains power supply.

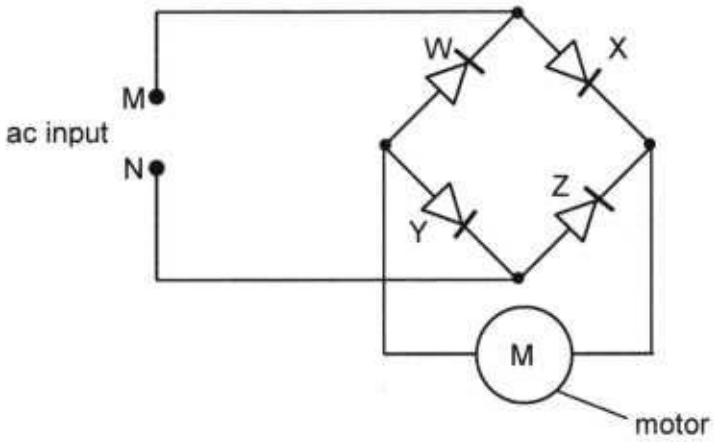

Fig. 10.1

(i) Describe the path of the current that produces one complete cycle of voltage across the motor.

.....

.....

..... [2]

(ii) On the axis provided sketch the output voltage against time. [2]

(iii) State the name of the instrument that can be used to display the waveform shown in **(b)(ii)**.

..... [1]

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11 (a) State the name of the nuclear reaction that produces energy in the Sun.

..... [1]

(b) Fig. 11. 1 shows decay curves for two radioactive samples J and K.

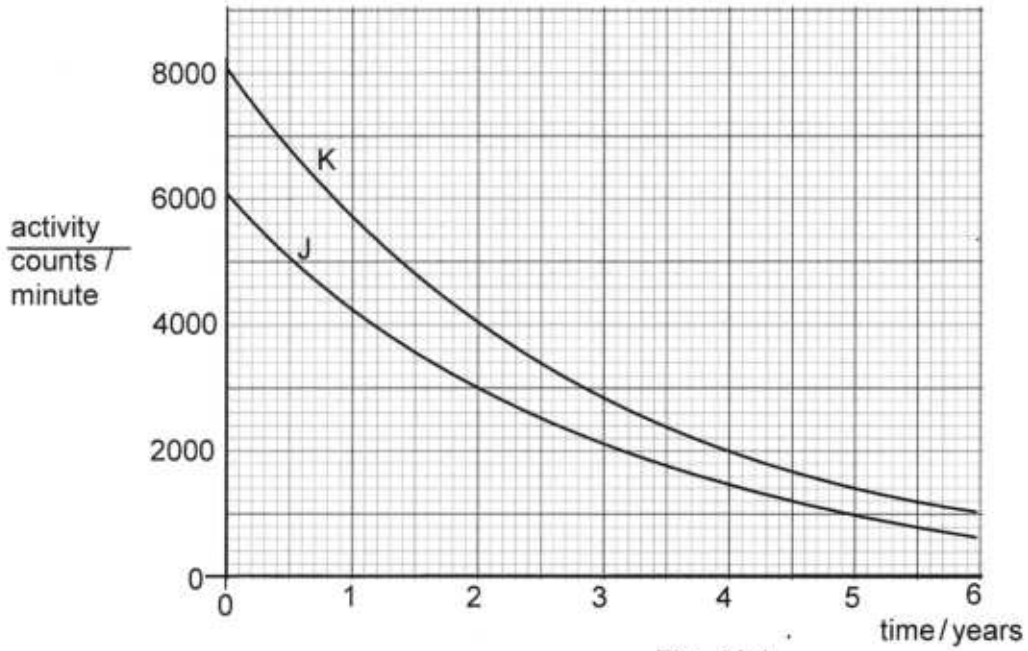

Fig. 11.1

State whether the samples are made from the **same** or **different** isotope.
Explain your answer.

statement .....

explanation .....

.....

[2]

(c) A radioactive element has a half-life of 8 hours.
The element decays for 56 hours and 500 atoms remain undecayed.

Determine the original number of atoms in the sample.

original number ..... [2]

(d) State the name of the particle that causes a chain reaction in a nuclear reactor.

..... [1]

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