BOTSWANA EXAMINATIONS COUNCIL
Botswana General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

3826182610

SCIENCE : DOUBLE AWARD **0569/03**

Paper 3 **October/November 2013**

2 hours

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces provided at the top of this page.
Write in dark blue or black pen.
You may use a soft pencil for any diagrams, graphs or rough working.
Do **not** use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Write your answers in the spaces provided on the question paper.
The number of marks is given in brackets [ ] at the end of each question or part question.
You may use a calculator.

A copy of the Periodic Table is printed on page 20.

For Examiner's Use	
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2	
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This document consists of **18** printed pages and **2** blank pages.

1 Fig. 1.1 shows a sketch of the speed-time graph of a car during a part of its journey. The car covered a distance of 10 000 m between 0 and 550 seconds.

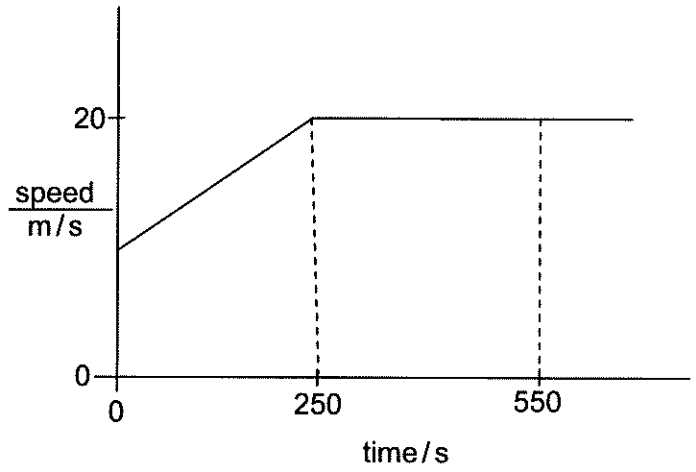


Fig. 1.1

(a) Describe the motion of the car from 0 to 550 seconds.

.....

.....[2]

(b) Calculate the distance travelled by the car between 250 and 550 seconds.

distance = ...[2]

(c) **(i)** Determine the distance travelled by the car between 0 and 250 seconds.

distance = ...[1]

(ii) Calculate the initial speed of the car.

initial speed = ...[2]

2 Fig. 2.1 shows a graph of a gaseous substance cooling from 200 °C.

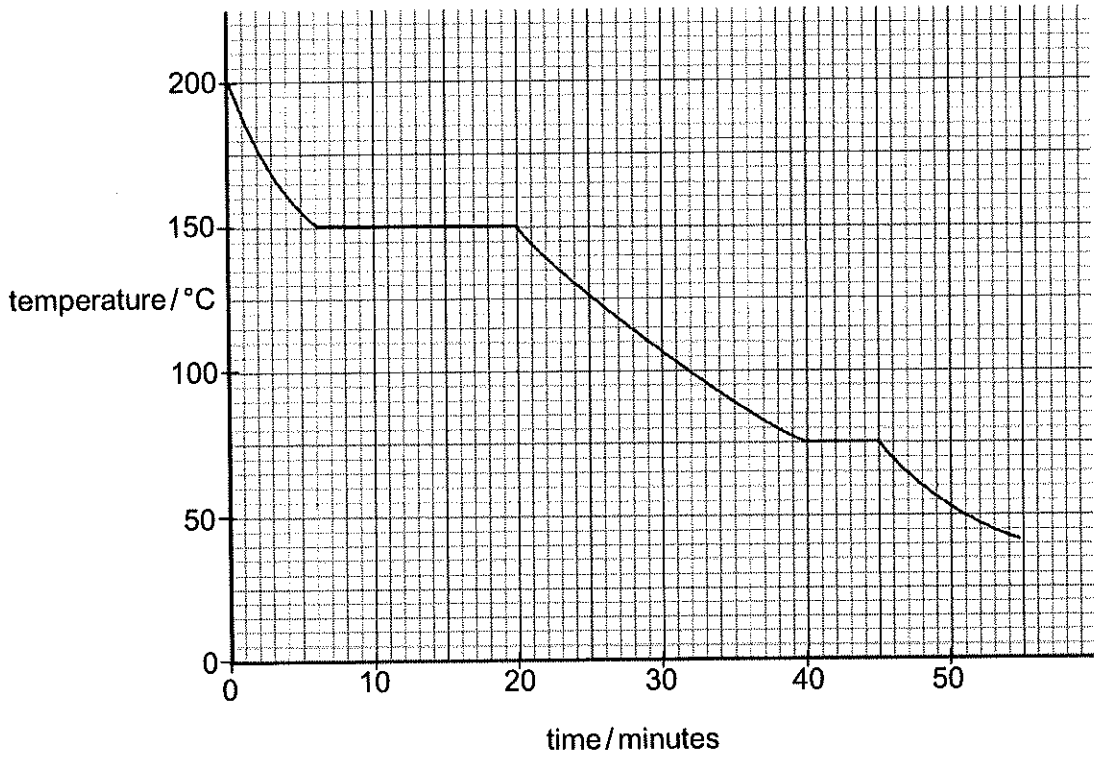


Fig. 2.1

(a) What is the freezing point of the substance?

.....[1]

(b) Tick the correct **two** boxes about the substance between 6 and 20 minutes.

It is changing into a solid ☐

It loses heat energy ☐

Its temperature is constant ☐

Its volume remains constant ☐ [2]

(c) State **two** differences between boiling and evaporation.

1.....

.....

2.....

.....[2]

3 Fig. 3.1 shows a ray of light moving from air into a parallel-sided glass block.

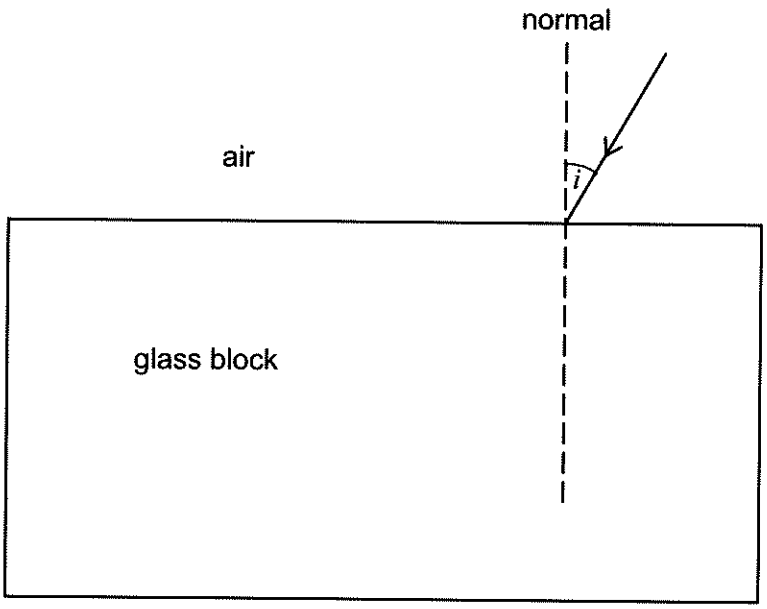


Fig. 3.1

(a) Complete the path of the ray in Fig. 3.1 until it leaves the glass block. [3]

(b) The refractive index of the glass block is 1.5.

Calculate the angle of refraction when the angle of incidence i is 35°.

angle of refraction = ...[2]

4 Fig. 4.1 shows two identical resistors, R_1 and R_2, connected in parallel to a 12 V battery.

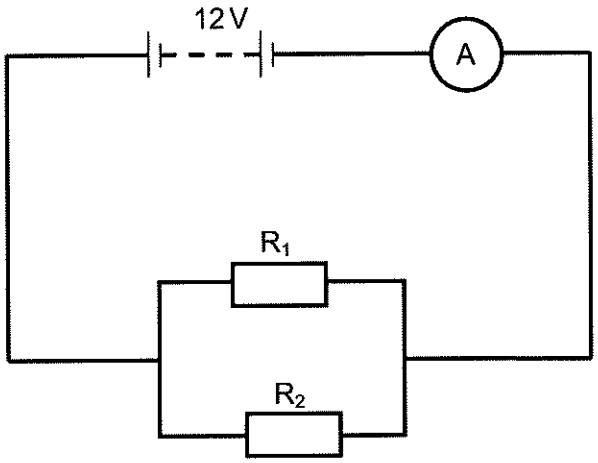


Fig. 4.1

(a) The ammeter reading is 3.0 A.

(i) State the current flowing through R_1.

current = ...[1]

(ii) Calculate the resistance of R_1.

resistance = ...[2]

(b) The circuit is changed so that R_1 and R_2 are now connected in series with the same ammeter and battery.

State and explain how these will affect

(i) the potential difference across each resistor,

effect.....

explanation.....

.....[2]

(ii) the ammeter reading.

effect.....

explanation.....

.....[2]

5 Fig. 5.1 shows some information written on an old mobile phone charger.

input	250 V
	50–60 Hz / 0.01 A
output	5.0 V / 0.35 A

Fig. 5.1

(a) This charger contains a step-down transformer.

Explain the meaning of step-down transformer.

.....

.....[1]

(b) Calculate the power output of the charger.

power output = ...[2]

(c) The charger has 500 turns in the output coil.

Calculate the number of turns in the input coil.

number of turns = ...[2]

6 **(a)** Explain what is meant by *radioactivity*.

.....

.....[1]

(b) An atom decays by emitting alpha particles and beta particles.

State the nature of the particles emitted.

alpha .....

beta .....[2]

(c) A Geiger-Muller tube with a thin mica window is used to detect alpha particles emitted by americium-241. The tube detected some radiation before the americium was brought close to it.

(i) State **one** source of the background radiation being detected.

.....[1]

(ii) Suggest a reason why the mica window on the end of the Geiger-Muller tube must be very thin to detect the radiation from americium-241.

.....[1]

7 **(a)** In an experiment two gas jars are set up as shown in Fig. 7.1.

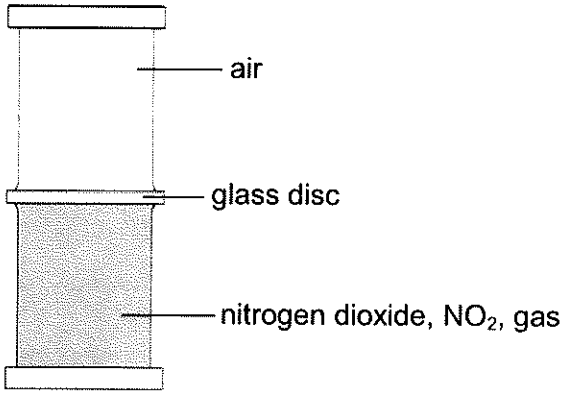


Fig. 7.1

Nitrogen dioxide, NO_2, is a brown gas.

(i) What observation will be made when the glass disc is removed?
Explain your answer.

observation .....

explanation .....

.....[2]

(ii) Calculate the relative molecular mass of NO_2.

relative molecular mass = ...[1]

(b) The experiment is repeated using bromine gas, Br_2, which has a relative molecular mass of 160.

State and explain how the rate of change observed when the glass disc is removed will differ from the rate of change in the first experiment.

.....

.....

.....

.....[3]

8 The equation for the reaction of calcium carbonate and hydrochloric acid is shown.

$$CaCO_3(s) + 2HCl(aq) \longrightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$$

(a) Write an ionic equation for the reaction.

.....[2]

(b) In an experiment, lumps of calcium carbonate were added in excess to 100 cm^3 of 0.10 mol/dm^3 hydrochloric acid.

(i) Calculate the number of moles of hydrochloric acid in 100 cm^3 of 0.10 mol/dm^3.

number of moles = ...[2]

(ii) Use your answer to **(b)(i)** and the equation to calculate the number of moles of carbon dioxide produced.

number of moles = ...[2]

(iii) Calculate the volume of carbon dioxide produced at room temperature and pressure (rtp).

volume = ...[2]

(c) Suggest **two** ways of increasing the rate of this reaction.

1.....

.....

2.....

.....[2]

9 Magnesium sulphate is soluble in water.

(a) Describe how crystals of magnesium sulphate are made using magnesium oxide powder and sulphuric acid as reactants.

.....

.....

.....

.....

.....

.....[4]

(b) A sample of water containing magnesium sulphate is hard.

(i) Name this type of hardness of water.

.....[1]

(ii) State the observation made when soap is shaken with hard water.

.....[1]

(iii) Give **one** method of removing this type of hardness of water.

.....[1]

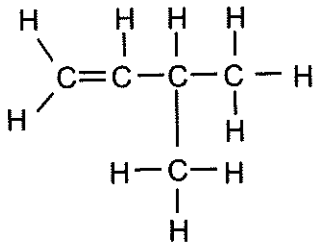
(iv) Describe a chemical test to confirm the presence of the sulphate, SO_4^{2-}, ions in the sample.

test .....

results .....

..... [3]

10 The structure of an organic compound **X** is



(a) What is the molecular formula of the compound **X**?

.....[1]

(b) What is the empirical formula of compound **X**?

.....[1]

(c) **(i)** To which homologous series does compound **X** belong?

.....[1]

(ii) Name another compound that belongs to the same homologous series as compound **X**.

.....[1]

(d) **(i)** Name **two** products formed when compound **X** burns completely in air.

1.....

2.....[2]

(ii) What other type of reaction can compound **X** undergo?

.....[1]

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