

Centre Number	Candidate Number	Candidate Name
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**NAMIBIA SENIOR SECONDARY CERTIFICATE**

**PHYSICAL SCIENCE ORDINARY LEVEL**

**4323/2**

PAPER 2

2 hours

Marks 100

**2020**

Additional Materials: Non-programmable calculator  
Ruler

**INSTRUCTIONS AND INFORMATION TO CANDIDATES**

- Candidates answer on the Question Paper in the spaces provided.
- Write your Centre Number, Candidate Number and Name in the spaces provided on 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 correction fluid.
- Do not write in the margin *For Examiner's Use*.
- Answer **all** questions.
- The number of marks is given in brackets [ ] at the end of each question or part question.
- You will lose marks if you do not show your working or if you do not use appropriate units.
- Take the weight of 1 kg to be 10 N (i.e. acceleration of free fall  $g = 10 \text{ m/s}^2$ ).
- The Periodic Table is printed on page 18.

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

Marker	
Checker	

This document consists of **18** printed pages and **2** blank pages.



Republic of Namibia

**MINISTRY OF EDUCATION, ARTS AND CULTURE**

- 1 Table 1.1 shows information about four substances **L**, **M**, **N** and **O**.

Table 1.1

substance	B.P/°C	M.P/°C	electrical conductivity when solid	electrical conductivity when liquid
<b>L</b>	low	low	does not conduct	does not conduct
<b>M</b>	high	high	does not conduct	conducts
<b>N</b>	high	high	conducts	conducts
<b>O</b>	high	high	does not conduct	does not conduct

- (a) Use Table 1.1 to identify the substance that has a

(i) simple covalent structure.

..... [1]

(ii) metallic bonding.

..... [1]

- (b) Fig. 1.1 shows an incomplete electronic structure of a sodium atom.

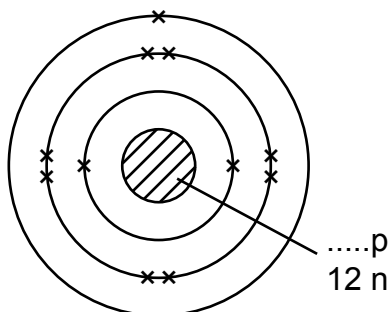


Fig. 1.1

(i) Complete the electronic structure by indicating the number of protons in the nucleus. [1]

(ii) Describe how sodium chloride is formed from sodium and chlorine atoms.

..... [2]

- (c) Substance **M** is an ionic compound. Suggest why substance **M** does not conduct electricity when in a solid form.

..... [2]

(d) Substance **O** is diamond which is an allotrope of carbon.

(i) Name another allotrope of carbon.

..... [1]

(ii) In terms of bonding, explain why diamond has a very high boiling point.

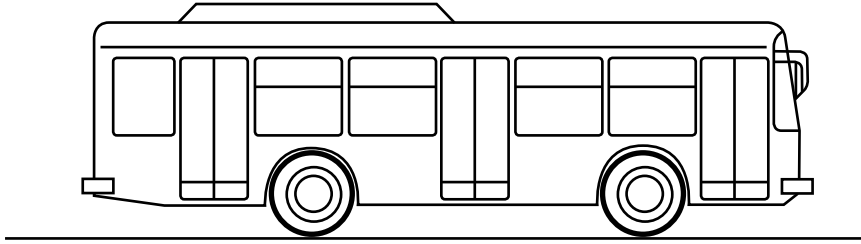
.....

.....

..... [2]

[10]

- 2 Fig. 2.1 shows a bus at rest at a bus stop. The engine causes a constant force of 1 800 N to act on the bus and the bus begins to move.



**Fig. 2.1**

- (a) What type of energy is transformed into kinetic energy when the bus starts to move?

..... [1]

- (b) After travelling 3.0 km, the air resistance acting on the bus balances the driving force of the engine and the bus travels at a constant speed.

- (i) Convert 3.0 km to meters.

3.0 km = ..... m [1]

- (ii) Calculate the work done by the bus against air resistance.  
Show your working and state the unit.

Work done = ..... [2]

- (iii) The mass of the bus is 15 000 kg.

Calculate the constant speed of the bus after travelling 3.0 km.

Speed = .....m/s [3]

(c) The force of the engine increased from 1 800 N to 2 000 N, causing the bus to accelerate constantly to 30 m/s in 50 seconds. Assume the frictional force is negligible.

(i) Determine the force that causes the acceleration of the bus.

..... [1]

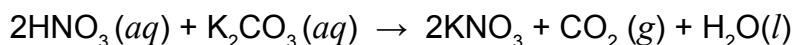
(ii) Calculate the acceleration of the bus during last part of the journey.

Acceleration = ..... m/s<sup>2</sup> [2]

[10]

- 3** Dilute nitric acid is titrated with potassium carbonate.  
A few drops of methyl orange indicator are added to the nitric acid to determine the end point. The products of the reaction are potassium nitrate, water and carbon dioxide.

The equation of the reaction is shown below.



- (a)** State the colour of nitric acid solution when drops of methyl orange are added.

..... [1]

- (b)** Nitric acid is a strong acid.  
Explain the difference between weak and strong acids.

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

- (c)** The results of the experiment show that 15 cm<sup>3</sup> of 0.4 mol/dm<sup>3</sup> nitric acid reacted completely with 20 cm<sup>3</sup> of potassium carbonate solution.  
Using the experimental results, describe how the solid potassium nitrate can be prepared using the two solutions.

.....  
.....  
.....  
.....  
..... [3]

(d) Calculate

(i) the number of moles in  $15 \text{ cm}^3$  of  $0.4 \text{ mol/dm}^3$  of nitric acid,

No. of moles = ..... [2]

(ii) the number of moles of potassium carbonate solution reacted,

No. of moles = ..... [2]

(iii) the volume of carbon dioxide produced at r.t.p.

Volume = .....  $\text{dm}^3$  [2]

[12]

4 A laser produces a ray of light with a frequency of  $5 \times 10^{14}$  Hz.

(a) State the speed of light in a vacuum.

..... [1]

(b) Calculate the wavelength of the light produced.

Wavelength = ..... m [2]

(c) Fig. 4.1 shows how the light ray travels from air into a glass block.

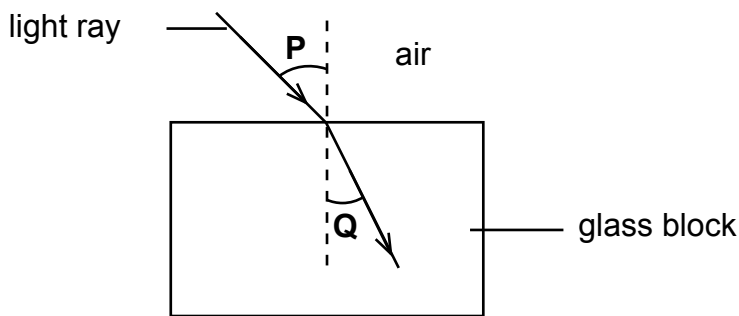


Fig. 4.1

(i) Name the angle labelled P.

..... [1]

(ii) Explain why the light ray changes direction as it enters the glass block.

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

[6]



- 5 Table 5.1 shows some information about the elements in Group VII.

**Table 5.1**

Element	B.P/°C	M.P/°C
chlorine	-35	-101
bromine	59	-7
iodine	184	114
astatine	337	302

- (a) State the least reactive element.

..... [1]

- (b) Describe the trend in the melting points of the elements in Table 5.1.

..... [1]

- (c) State with a reason, the state of matter of bromine at  $-5^{\circ}\text{C}$ .

State.....

Reason..... [2]

- (d) Iodine reacts with strontium metal to form strontium iodide.

- (i) Write the chemical formula of strontium iodide.

..... [1]

- (ii) Explain why there is a reaction when chlorine gas is added to strontium iodide.

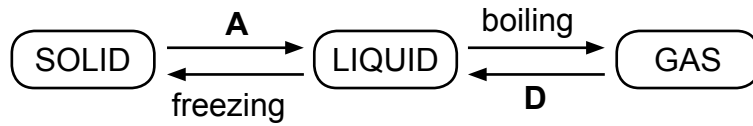
.....

.....

..... [2]

[7]

- 6 Fig. 6.1 shows arrows that indicate the processes between the states of matter of substance **W**.



**Fig. 6.1**

- (a) Use Fig. 6.1 to identify the processes labelled **A** and **D**.

**A** .....

**D** .....

[2]

- (b) With reference to kinetic particle theory, describe what happens to substance **W** when freezing.

.....  
 .....  
 .....  
 .....

[3]

- (c) A solid sample of substance **W** is at rest with an area in contact with the ground of 0.050 m<sup>2</sup>. The sample exerts a pressure on the ground of 100 Pa. Calculate the weight of the sample.

Weight.....N

[2]

[7]

- 7 Table 7.1 shows some properties of organic compounds.

**Table 7.1**

homologous series	functional group	reactivity
(i)	C = C	unsaturated
alkane	C - C	saturated
carboxylic acid	(ii)	unsaturated

- (a) Complete Table 7.1 by filling in the missing information for (i) and (ii). [2]

- (b) Butane is a member of the alkane homologous series.

- (i) State the number of carbon atoms in the structure of butane.

..... [1]

- (ii) In terms of addition reaction, describe how butane is formed.

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

- (c) Ethanoic acid reacts with ethanol to form an ester and water.

- (i) Draw the molecular structure of ethanol.

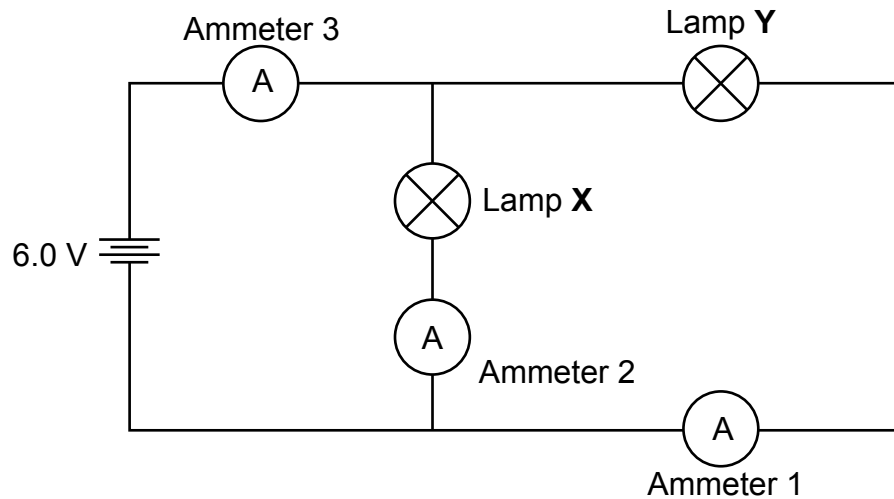
[2]

- (ii) State the name of the ester formed.

..... [1]

[8]

- 8 Fig. 8.1 shows a circuit with two Lamps **X** and **Y** and Ammeters 1, 2 and 3. The reading on Ammeter 3 is 0.60 A and the reading on Ammeter 2 is 0.20 A.



**Fig. 8.1**

- (a) (i) What is the current in Lamp **Y**?

..... [1]

- (ii) Explain why Lamp **Y** is brighter than Lamp **X**.

..... [1]

- (b) Calculate the resistance of Lamp **X**.

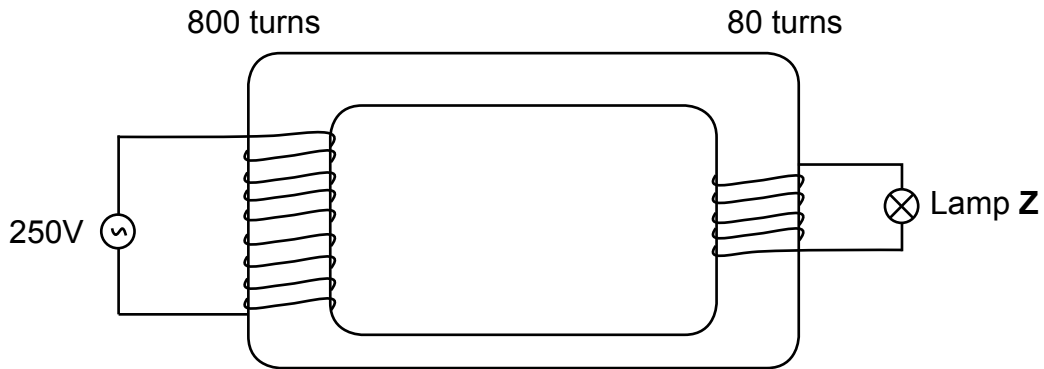
Resistance = ..... $\Omega$  [2]

- (c) Calculate the combined resistance of the circuit.

Resistance = ..... $\Omega$  [3]

(d) Lamp **Z** can be used in a country where the mains supply is 250 V a.c.

Fig. 8.2 shows the transformer used to light Lamp **Z** using 250 V a.c mains supply.



**Fig. 8.2**

(i) Write down the ratio of the number of turns on secondary coil to the number of turns on primary coil.

.....

[1]

(ii) Use Fig. 8.2 to calculate the potential difference across Lamp **Z**.

Potential difference = ..... V [2]

[10]

- 9 Fig. 9.1 shows a blast furnace used in the extraction of iron from its ore.

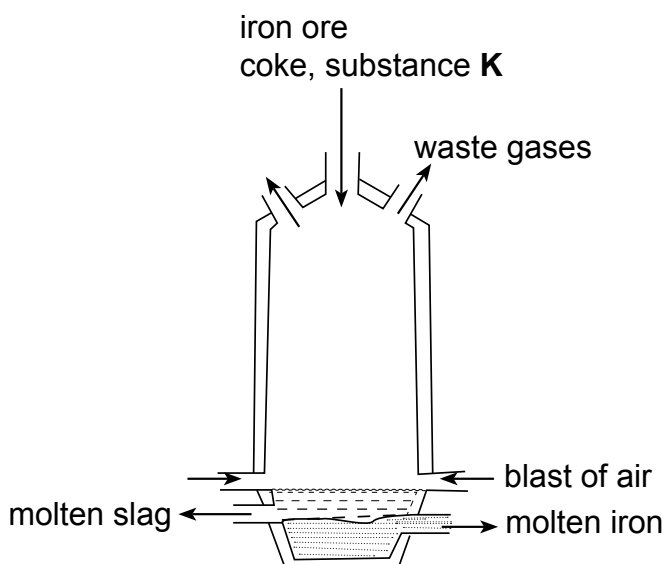


Fig. 9.1

- (a) Name substance **K**.

..... [1]

- (b) The equations represent some reactions which take place in the blast furnace.

**A:** carbon + oxygen  $\rightarrow$  carbon dioxide

**B:** carbon monoxide + iron(III) oxide  $\rightarrow$  iron + carbon dioxide

**C:** carbon dioxide + carbon  $\rightarrow$  carbon monoxide

- (i) State which reaction **A**, **B** or **C** is a combustion reaction.

..... [1]

- (ii) Identify the oxidising agent in reaction **B**.

Give a reason for your answer.

Oxidising agent .....

Reason..... [2]

- (iii) Write a balanced chemical equation for reaction **C**.

..... [2]

- (c) There are different types of steel, one type is known as mild steel.

- (i) Name **one** use of mild steel.

..... [1]

- (ii) Explain why pure iron is malleable.

.....

..... [2]

[9]

- 10 In a science class, a plastic rod is rubbed with a dry cloth as shown in Fig. 10.1. The plastic rod becomes negatively charged.

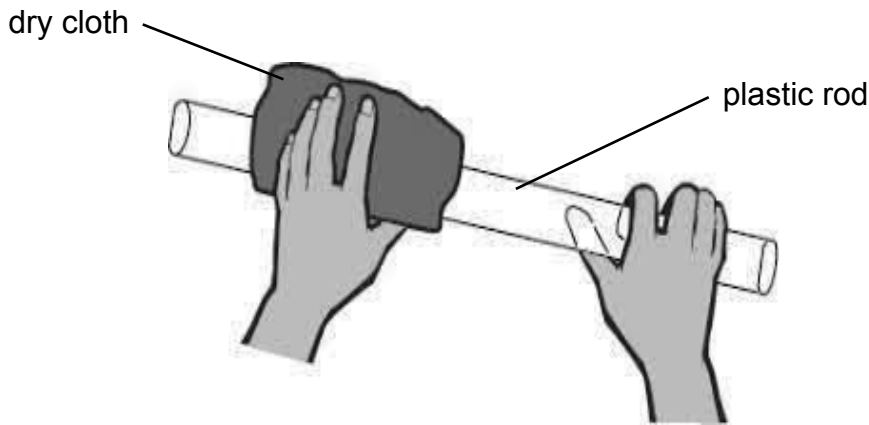


Fig. 10.1

- (a) In terms of electrons transfer, state how the plastic rod becomes charged negatively.

..... [1]

- (b) The charged plastic rod is brought close to a thin sheet of steel. The plastic rod and steel sheet repelled each other.

State and explain the cause of the repulsion.

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

- (c) Steel is a ferromagnetic material that can be magnetised.

- (i) Describe **one** method of making a permanent magnet.

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

- (ii) Fig. 10.2 shows an iron rod and a magnet placed close to each other.



Fig. 10.2

Circle the word or phrase in the list that describes the behaviour of the iron rod and the magnet.

- attraction**      **repulsion**      **no force**      [1]  
 [6]

**11** A radioactive source, lead ( $^{214}_{82}\text{Pb}$ ), decays by emitting two alpha particles and some gamma rays.

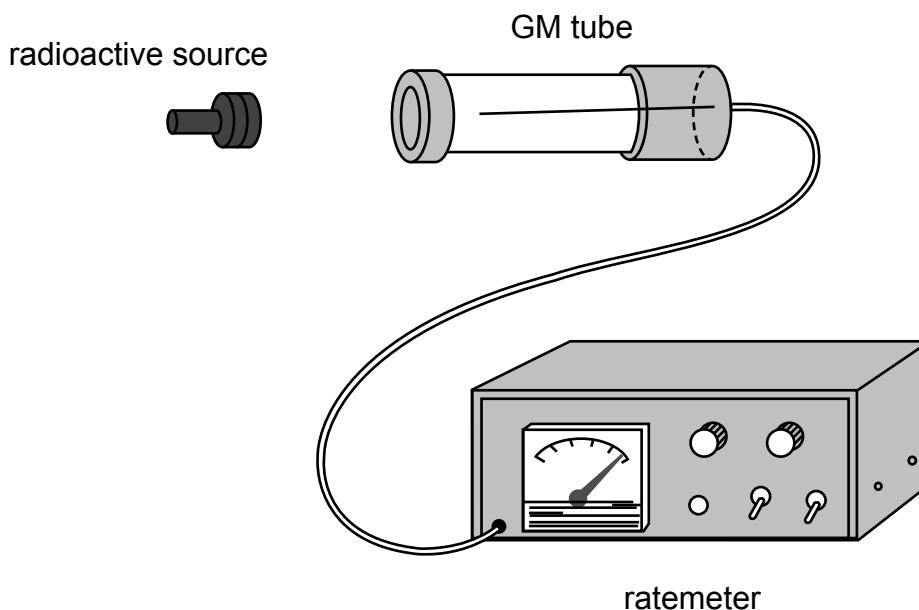
**(a)** State the number of protons emitted in the decay.

..... [1]

**(b)** Complete the word equation of the decay.

Lead nucleus  $\rightarrow$  ..... nucleus + alpha particles [1]

**(c)** A radioactive source, lead, was placed near a GM tube for the radiation to be detected as shown in Fig. 11.1.



**Fig. 11.1**

**(i)** Name the material that can be used for the lining of the box used for storing radioactive sources.

..... [1]

**(ii)** The half-life of radioactive lead is 27 minutes.

A sample of 900  $\mu\text{g}$  of lead-214 is left to decay.

Calculate the amount of the sample left after 81 minutes.

mass of sample left = .....  $\mu\text{g}$  [2]

[5]



12 (a) Catalytic reduction of nitrogen monoxide by carbon monoxide is the method of converting pollutant gases to form less harmful gases in a car exhaust system.

(i) Give **two** of the less harmful gases formed.

1 .....

2 ..... [2]

(ii) Name the common catalyst used in the catalytic converter.

..... [1]

(iii) State how carbon monoxide is formed in cars.

.....

..... [1]

(iv) Explain **two** negative impacts of the pollutant gases emitted by cars to the environment.

1 .....

Explanation .....

.....

2 .....

Explanation .....

..... [4]

(b) With reference to water resources, discuss the dangers of overuse of fertilisers.

.....

.....

..... [2]

[10]



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