Centre Number	Candidate Number	Candidate Name

NAMIBIA SENIOR SECONDARY CERTIFICATE

PHYSICAL SCIENCE HIGHER LEVEL

8322/2

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 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 correction fluid.
- Do not write in the margin *For Examiner's Use*.

Section A

- Answer **all** questions.

Section B

- Answer any **two** questions, **one** on Physics, **one** on Chemistry.
- Write your answers on the answer sheets at the end of this booklet.
- The number of marks is given in brackets [ ] at the end of each question or part question.
- A copy of the Periodic Table is printed on page 20.

For Examiner`s Use	
Section A	
1	
2	
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4	
5	
6	
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Section B	
8	
OR	
9	
10	
OR	
11	
Total	

Marker	
Checker	

This document consists of **20** printed pages.

Republic of Namibia

MINISTRY OF EDUCATION, ARTS AND CULTURE

SECTION A

Answer **all** questions in this section.

1 **(a)** A grade 12 student uses a ripple tank to investigate what happens to the water waves as they pass through a wide gap.

(i) Complete Fig.1.1 to show the water waves after they have passed the gap to the other side of the barrier. [2]

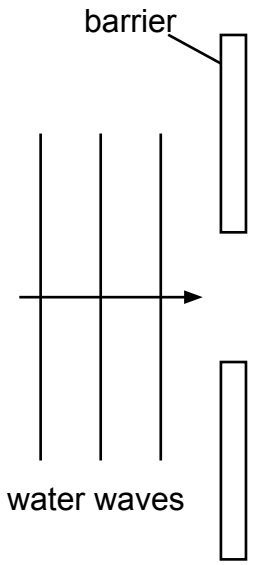

Fig. 1.1

(ii) The student repeats the experiment using a narrower gap.
State the name of the process being investigated and describe the difference in the effect of the narrower gap on the water waves.

.....

.....

..... [2]

(b) The waves approaching the barrier in Fig. 1.1 have a wavelength of 1.4 cm and travel at a velocity of 12 cm/s.

Calculate the frequency of the waves. Give your answer together with the unit.

Frequency = ... [2]

(c) Two water waves, **A** and **B** are traveling simultaneously in a ripple tank as shown in Fig. 1.2.
Use the principle of superposition to explain the interference between the two waves.
Complete Fig. 1.2 by showing the resultant displacement of the two waves in the box provided.

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.....

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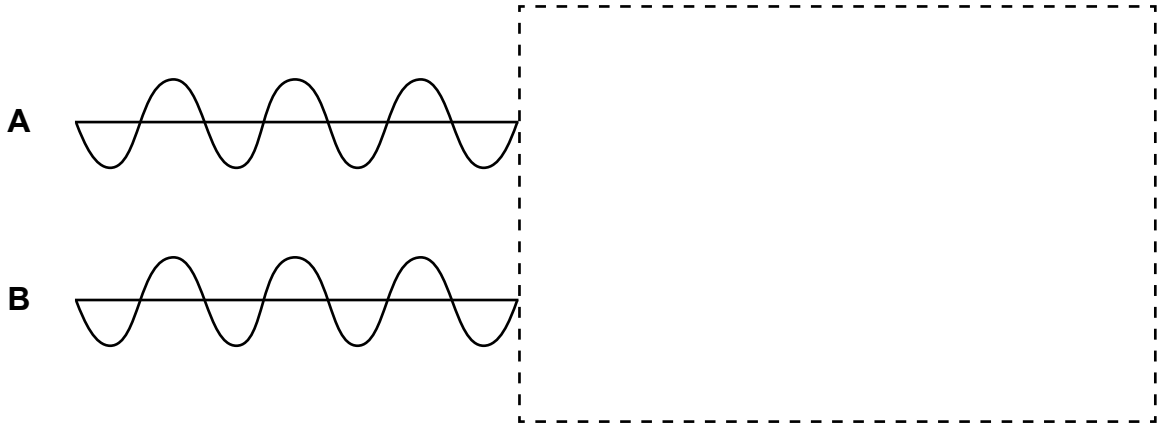

Fig. 1.2

[3]

[9]

2 Oxides are compounds which contain oxygen combined with an element.

Oxides are classified as: acidic, alkaline, amphoteric and basic

(a) Using the above terms only, complete the table to describe the oxides of the elements of the third period of the Periodic Table, sodium to sulfur.

Na_2O	MgO	Al_2O_3	SiO_2	P_4O_{10}	SO_2	Cl_2O_7
						acidic

[4]

(b) Give the names of any **two** elements from potassium to bromine which form more than one coloured oxide.

.....

..... [2]

(c) Oxygen is carried by haemoglobin in the blood to the rest of the human body. Haemoglobin consists of iron(II) ions linked to proteins to form a complex ion.

(i) Describe how the iron ion forms a complex ion in haemoglobin.

.....

.....

.....

..... [2]

(ii) Explain the importance of the complex ion in the transfer of oxygen in the human body.

.....

.....

.....

..... [2]

[10]

3 A student of weight 640 N rides a skateboard at a local skate park. He starts from rest at the top of the track as shown in Fig. 3.1 and begins a descent down the track, always maintaining contact with the surface. The mass and the friction of the skateboard are negligible.

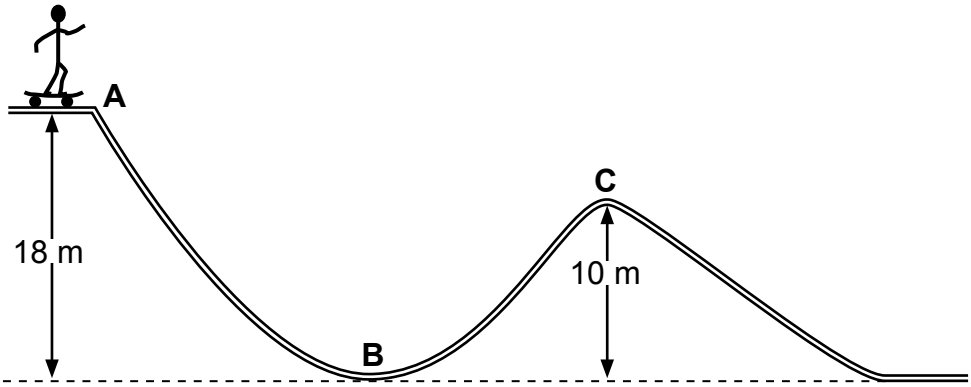

Fig. 3.1

He starts from point **A**, 18 m above the surface and travels through point **B** to point **C** which is 10 m above the surface.

(a) State the energy conversions of the student from point **A** through point **B** to point **C**.

.....

..... [2]

(b) **(i)** Calculate the potential energy that the student has at position **A**.

Potential Energy = ... J [2]

(ii) State the value of the energy the student has at point **B**.

Energy = ... J [1]

(c) He then ascends to the other side of the dip to point **C**, 10.0 m above the ground.
Calculate the student's speed when he reaches this point **C**.

Speed = ... m/s [4]

[9]

4 Nitrogen from the air reacts with hydrogen obtained mainly from natural gas to form ammonia. The reaction is reversible and it reaches equilibrium.
The reversible reaction is given below.

$$N_2\,(g) + 3H_2\,(g) \rightleftharpoons 2NH_3\,(g) \qquad \Delta H = -92\ kJ\ mol^{-1}$$

(a) Explain what is meant by the term *chemical equilibrium*.

.....

..... [2]

(b) With reference to Le Chatelier's Principle, explain how the reaction will shift after the increase in

(i) temperature,

.....

.....

.....

..... [2]

(ii) pressure.

.....

.....

.....

..... [2]

(c) At equilibrium it was found that 1.05 mol of N_2, 2.65 mol of H_2 and 0.9 mol of NH_3 was present in the flask with volume 1.5 dm^3.

Use this information to calculate the equilibrium constant, K_C.

K_C = ...$(mol/dm^3)^2$ [4]

[10]

5 Fig. 5.1 shows a thermos flask diagram. Its design includes the following, silvered surface, vacuum, double-walled glass container, plastic cap and plastic outer cover.

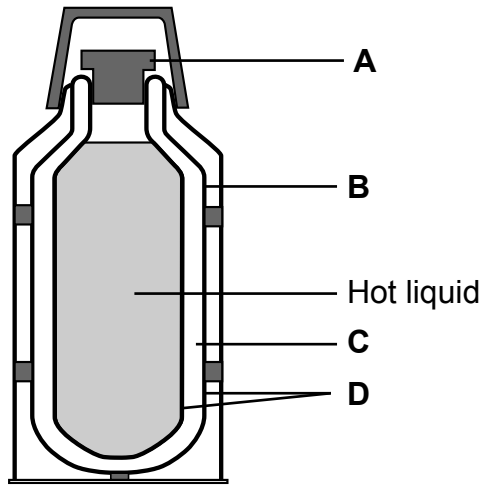

Fig. 5.1

Discuss **four** design features, **A**, **B**, **C** and **D** of the thermos flask that are useful for preventing heat from escaping from the flask.

In each case,

- state the name of the feature on the thermos flask.

- state which method of heat transfer is being prevented.

- explain how the feature prevents this method of heat transfer.

A .....

.....

..... [2]

B .....

.....

..... [2]

C .....

.....

..... [2]

D .....

.....

..... [2]

[8]

6 Fig. 6.1 show an electric circuit with a capacitor **C** and a variable resistor **R**. The capacitor is charged through the variable resistor.

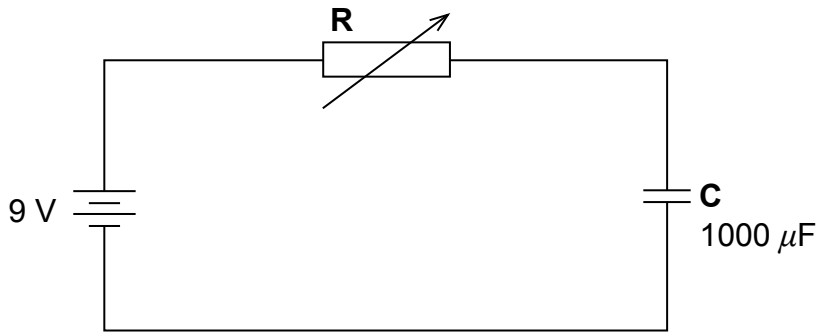

Fig. 6.1

(a) Describe a capacitor and state **two** functions of capacitors in simple electric circuits.

.....

.....

..... [2]

(b) Calculate the charge store in the capacitor when it is fully charged.
Show your working.

Charge.....C [2]

[4]

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7 The graph in Fig. 7.1 indicates the cumulative global emission of carbon dioxide (CO_2) from the burning of fossil fuels over a period of time.

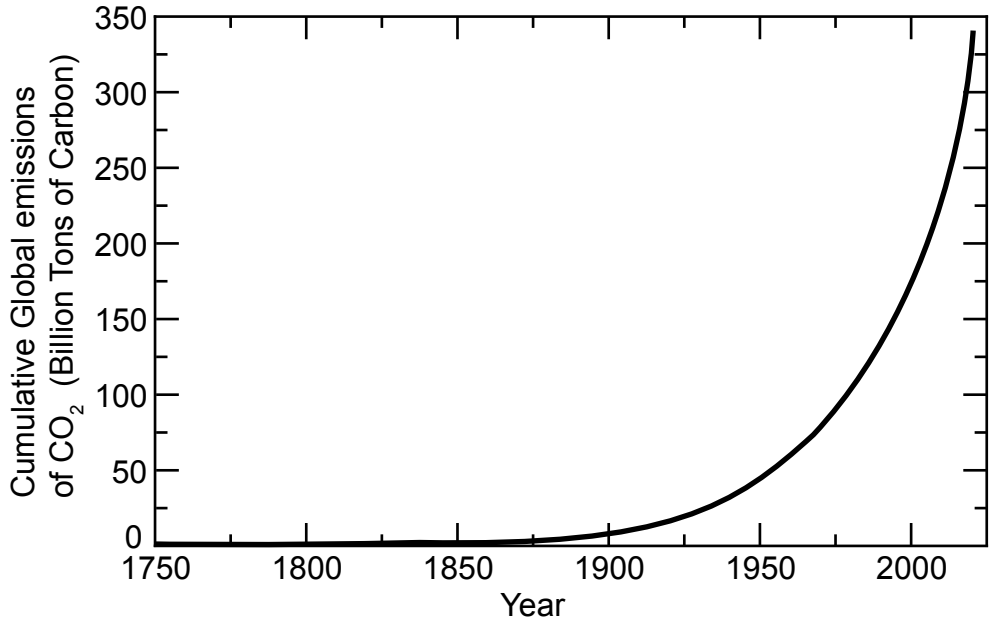

Fig. 7.1

(a) Suggest and explain what can be concluded from the information in the graph.

.....

.....

.....

..... [2]

(b) Carbon dioxide and other gases cause acid rain. State **two** effects of acid rain on the environment.

1 .....

2 ..... [2]

(c) Name and explain **one** other effect that excess carbon dioxide in the atmosphere have on the environment.

.....

.....

.....

..... [2]

(d) State **two** ways of minimising the increase in CO_2 concentration.

1 .....

.....

2 .....

..... [2]

(e) State any other **two** pollutant gases that are produced as a result of combustion of fossil-fuels.

1 .....

2 ..... [2]

[10]

SECTION B

Answer **one** Physics and **one** Chemistry question.

Write your answers on the answer sheets provided at the end of the booklet.

PHYSICS SECTION

8 **(a)** Use the kinetic particle theory of matter to explain

(i) the difference between a solid and a liquid, [3]

(ii) why latent heat is required as ice (solid) changes into water (liquid), [2]

(iii) how a change in temperature affects Brownian motion, [2]

(iv) how an increase in temperature causes an increase of pressure when a gas is heated in a sealed container at a constant volume. [3]

(b) **(i)** Explain why momentum is a vector quantity. [1]

(ii) State how the change in momentum of a body is related to the force acting on it and the time for which this force acts. [2]

(iii) Give a brief description of an experiment that could be performed in the laboratory which would demonstrate the principle of conservation of momentum of a body.

Your description should include details of the apparatus that would be used and the measurement that would be taken. You should discuss how the results would be used to demonstrate the validity of this principle. [7]

[20]

9 **(a)** **(i)** Explain the increase in electric resistance of a metal with a rise in temperature. [2]

(ii) Sketch the voltage versus current graph for the tungsten filament of a light bulb. Your sketch graph should include the origin. [2]

(b) A generator produces 120 kW. Electricity can be transmitted either at 240 V or at 2 400 V using a step-up transformer through a given distance in a specified time. The cables have total resistance of 400 Ω.

(i) Explain why energy loss is less when the electricity is transmitted at high voltage. [3]

(ii) Use the information given to calculate the power loss in the cables at 240 V and 2 400 V. [3]

(c) A student demonstrates the photo-electric effect using a disc of aluminium placed on an electroscope. The work function of aluminium is 6.6×10^{-19} J. The Planck's constant $h = 6.6 \times 10^{-34}$ Js.

(i) Describe the meaning of the term photo-electric effect. [2]

(ii) Calculate the maximum wavelength of light that will eject electrons from aluminium. The speed of light is 3×10^{8} m/s. [3]

(iii) The electroscope is negatively charged and then exposed to ultraviolet light of wavelength 260 nm.

Calculate the kinetic energy of an electron emitted from the aluminium disk by a photon of this light. [3]

(iv) Using specific examples, describe the dual wave-particle nature of electrons. [2]

[20]

CHEMISTRY SECTION

10 **(a)** When a bottle of wine is open, exposed to air, its aroma and flavour changes gradually.

(i) Describe a chemical effect that oxygen, from air, can have on wine. [2]

(ii) Describe a further reaction that can occur between the product of the reaction in **(a) (i)** and the unreacted wine in the same bottle. [2]

(b) **(i)** In terms of nucleophilic substitution, describe the reaction of bromoethane, C_2H_5Br, with ammonia, NH_3, to form a primary amine. [3]

(ii) Show that the formation of carbohydrates, involves condensation polymerisation reactions. Name **two** other polymers that are formed through condensation polymerisation reactions. [3]

(c) Iron is extracted from its ore, haematite, in a blast furnace by reduction with carbon monoxide.

(i) Describe the chemical processes that form the carbon monoxide. [3]

(ii) Describe the chemical processes that form the slag. [3]

(iii) Explain why a piece of iron left in a moist condition would corrode while a piece of aluminium in similar conditions would not corrode. [2]

(iv) With reference to iron, explain why it is necessary for some metals to be used as alloys and give **one** example of an alloy of iron. [2]

[20]

11 **(a)** **(i)** Explain why nitrogen is unreactive. [2]

(ii) Describe with a named example the main source of oxides of nitrogen as pollutant to the environment. [3]

(iii) The uncontrolled use of nitrogenous fertilisers can cause environmental damage to lakes and streams. This is known as eutrophication.
Outline the process and effects of eutrophication. [4]

(b) Describe, with observations, the reaction of aqueous iodide ions with aqueous lead (II) nitrate. Write an equation, including state symbols, for this reaction. [4]

(c) (i) In a reaction, a metal carbonate reacts completely with dilute hydrochloric acid. In terms of collisions between the reacting particles and an energy barrier (activation energy), explain two different ways of increasing the rate of this chemical reaction. [4]

(ii) Outline the test for the gas produced in **(c)(i)**. [3]

[20]

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Answer sheets for **Section B**

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DATA SHEET
The Periodic Table of the Elements

Group I	Group II						Group III	Group IV	Group V	Group VI	Group VII	Group 0
					1 **H** Hydrogen 1							4 **He** Helium 2
7 **Li** Lithium 3	9 **Be** Beryllium 4						11 **B** Boron 5	12 **C** Carbon 6	14 N Nitrogen 7	16 **O** Oxygen 8	19 **F** Fluorine 9	20 **Ne** Neon 10
23 **Na** Sodium 11	24 **Mg** Magnesium 12						27 **Al** Aluminium 13	28 **Si** Silicon 14	31 **P** Phosphorus 15	32 **S** Sulfur 16	35,5 **Cl** Chlorine 17	40 **Ar** Argon 18
39 **K** Potassium 19	40 **Ca** Calcium 20	45 **Sc** Scandium 21	48 **Ti** Titanium 22	51 **V** Vanadium 23	52 **Cr** Chromium 24	55 **Mn** Manganese 25	56 **Fe** Iron 26	59 **Co** Cobalt 27	59 **Ni** Nickel 28	64 **Cu** Copper 29	65 **Zn** Zinc 30	70 **Ga** Gallium 31	73 **Ge** Germanium 32	75 **As** Arsenic 33	79 **Se** Selenium 34	80 **Br** Bromine 35	84 **Kr** Krypton 36
85 **Rb** Rubidium 37	88 **Sr** Strontium 38	89 **Y** Yttrium 39	91 **Zr** Zirconium 40	93 **Nb** Niobium 41	96 **Mo** Molybdenum 42	**Tc** Technetium 43	101 **Ru** Ruthenium 44	103 **Rh** Rhodium 45	106 **Pd** Palladium 46	108 **Ag** Silver 47	112 **Cd** Cadmium 48	115 **In** Indium 49	119 **Sn** Tin 50	122 **Sb** Antimony 51	128 **Te** Tellurium 52	127 ***I*** Iodine 53	131 **Xe** Xenon 54
133 **Cs** Caesium 55	137 **Ba** Barium 56	139 **La** Lanthanum 57 *	178 **Hf** Hafnium 72	181 **Ta** Tantalum 73	184 **W** Tungsten 74	186 **Re** Rhenium 75	190 **Os** Osmium 76	192 **Ir** Iridium 77	195 **Pt** Platinum 78	197 **Au** Gold 79	201 **Hg** Mercury 80	204 **Tl** Thallium 81	207 **Pb** Lead 82	209 **Bi** Bismuth 83	**Po** Polonium 84	**At** Astatine 85	**Rn** Radon 86
Fr Francium 87	226 **Ra** Radium 88	227 **Ac** Actinium 89 †															

***58 - 71 Lanthanoid series**
†90 - 103 Actinoid series

140 **Ce** Cerium 58	141 **Pr** Praseodymium 59	144 **Nd** Neodymium 60	**Pm** Promethium 61	150 **Sm** Samarium 62	152 **Eu** Europium 63	157 **Gd** Gadolinium 64	159 **Tb** Terbium 65	162 **Dy** Dysprosium 66	165 **Ho** Holmium 67	167 **Er** Erbium 68	169 **Tm** Thulium 69	173 **Yb** Ytterbium 70	175 **Lu** Lutetium 71
232 **Th** Thorium 90	**Pa** Protactinium 91	238 **U** Uranium 92	**Np** Neptunium 93	**Pu** Plutonium 94	**Am** Americium 95	**Cm** Curium 96	**Bk** Berkelium 97	**Cf** Californium 98	**Es** Einsteinium 99	**Fm** Fermium 100	**Md** Mendelevium 101	**No** Nobelium 102	**Lr** Lawrencium 103

Key

a
X
b

a = relative atomic mass
X = atomic symbol
b = proton (atomic) number

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).