Centre Number	Candidate Number	Candidate Name

NAMIBIA SENIOR SECONDARY CERTIFICATE

PHYSICAL SCIENCE HIGHER LEVEL 8322/2

PAPER 2 2 hours

Marks 100 **2017**

Additional materials: Non-programmable calculator

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 and **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.
- 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 m/s^2).
- The Periodic Table is printed on page 20.

For Examiner`s Use	
Section A	
Section B	
1	
2	
3	
4	
Marker	
Checker	

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

Republic of Namibia

MINISTRY OF EDUCATION, ARTS AND CULTURE

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SECTION A

Answer **all** the questions in this section.

1 The following is a list of experimental techniques.

chromatography	**crystallisation**	**filtration**
fractional distillation	**simple distillation**	**precipitation**

From the list choose a suitable technique for each of the following.

(a) Identification of ions in a water sample.

..... [1]

(b) Obtaining pure water from pond water.

..... [1]

(c) Obtaining a soluble salt prepared from an acid and excess metal oxide.

..... [1]

(d) Purification of table salt from sea salt.

..... [1]

(e) Separation of crude oil fractions.

..... [1]

[5]

2 Trolley **A** of mass 6 kg runs down a sloping track as shown in Fig. 2.1.

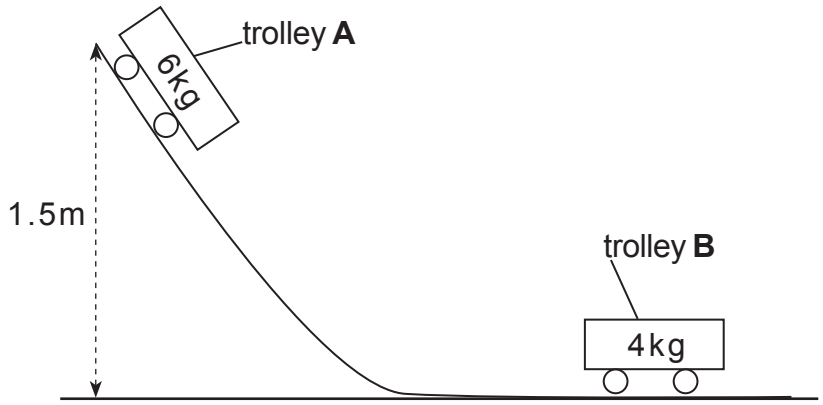


Fig. 2.1

The vertical distance through which trolley **A** moves is 1.5m.

(a) Ignoring friction between trolley **A** and the track, calculate the kinetic energy of trolley **A** at the bottom of the track. (Take g = 10N/kg).

Kinetic energy..... [3]

(b) Trolley **A** then collides with a second stationary trolley **B** of 4kg and the trolleys lock together.

(i) Calculate the velocity of trolley **A** before the impact.

Velocity of trolley **A**..... m/s [2]

(ii) Calculate the velocity of the two trolleys after the impact.

Velocity of the two trolleys .....m/s [3]

[8]

3 Table 3.1 shows information about halogens.

Table 3.1

Element	Electronegativity	State at room temperature	Boiling Point/°C
fluorine	4.0	gas	−188
chlorine	3.0	gas	−34
bromine	2.8	liquid	59
iodine	2.7	solid	184

(a) State **one** other property, of the elements in the table, that also shows a trend.

..... [1]

(b) Explain the trend in boiling point from fluorine to iodine.

.....

.....

.....

.....

.....

..... [3]

(c) Fluorine can oxidise chloride ions to chlorine.

(i) Use the information in the table to explain this fact.

.....

.....

.....

..... [2]

(ii) Write down the half-equation for this oxidation.

..... [2]

[8]

For Examiner's Use

4 The displacement-time graph of a vibrating tuning fork is shown in Fig. 4.1.

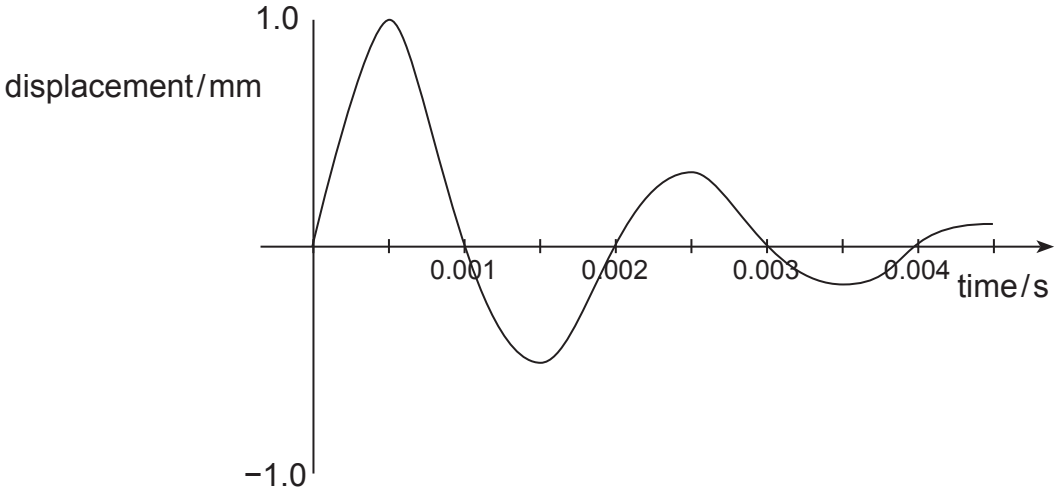


Fig. 4.1

(a) Describe the motion of the tuning fork.

..... [1]

(b) Use the graph in Fig. 4.1 to determine

(i) the maximum amplitude,

Maximum amplitude ..... mm [1]

(ii) the frequency of the tuning fork.

Frequency.....Hz [3]

(iii) State the time at which the speed and the acceleration of the tuning fork is maximum.

Time when speed is maximum .....s

Time when acceleration is maximum .....s [2]

(c) Explain why the amplitude decreases with time.

.....

.....

.....

..... [2]

(d) (i) When a vibrating tuning fork is held against the body of a musical instrument, the sound produced has the same frequency as the frequency of the tuning fork.

Explain why.

.....

.....

.....

.....

.....

..... [3]

(ii) Describe how the body of a musical instrument produces a sound wave.

.....

.....

.....

..... [2]

[14]

For Examiner's Use

5 Fig. 5.1 shows the process of extracting aluminium from its ore.

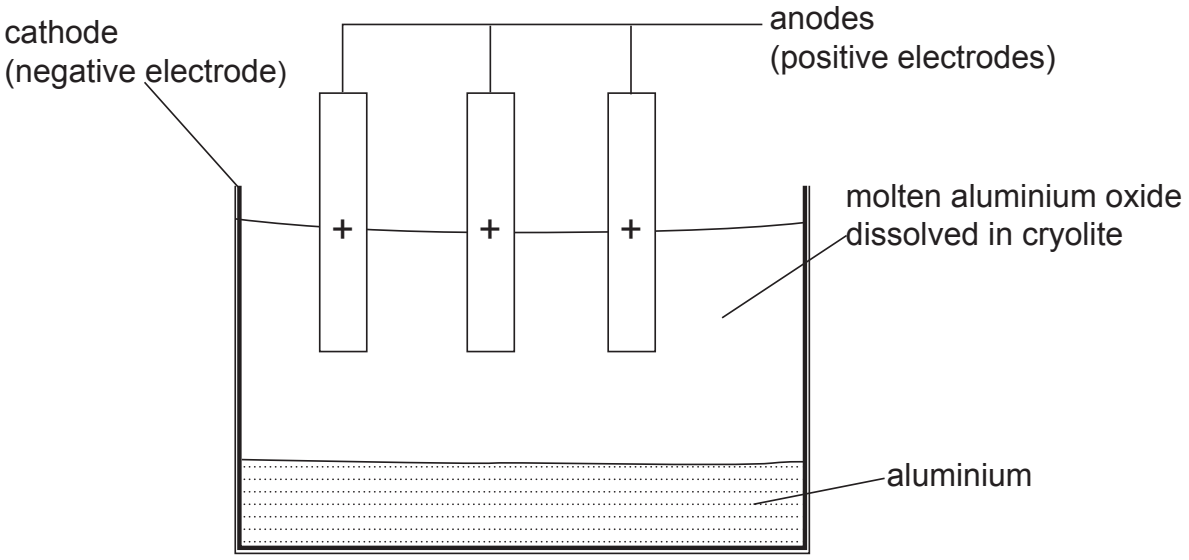


Fig. 5.1

(a) State the name of the ore of aluminium and give the formula of the main constituent in the ore.

..... [1]

(b) Aluminium is a very reactive metal and yet it is used to make products such as cooking pans.

Explain why aluminium is used to make such items.

.....

.....

.....

.....

..... [3]

(c) Write down equations for the reactions occurring at the anodes and cathode.

Anodes .....

Cathode ..... [2]

(d) Copper is extracted from its ore, copper pyrites, which is mainly copper sulfide. Copper sulfide is separated from the ore and heated in oxygen to remove sulfur as sulfur dioxide.

Explain why aluminium cannot be extracted in this way.

.....

..... [1]

[7]

For Examiner's Use

6 Fig. 6.1 shows a sketch of a generator.

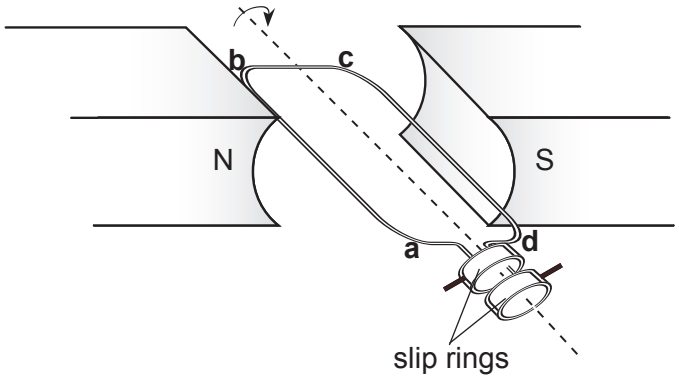


Fig. 6.1

(a) What type of generator is shown in Fig. 6.1?

..... [1]

(b) Explain how current is produced by the generator in Fig. 6.1.

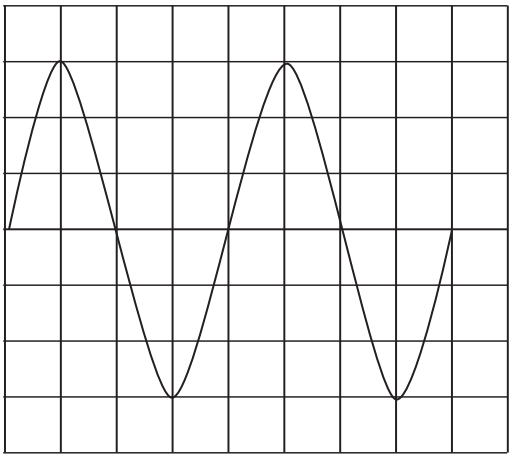
.....

.....

.....

..... [2]

(c) The output of the generator is connected to a cathode-ray oscilloscope (c.r.o.). Fig. 6.2 shows a screen of the c.r.o.



settings

time base: 5 ms / div

y - gain : 8 v / div

Fig. 6.2

(i) Use the diagram to calculate the peak voltage.

Peak voltage..... [2]

(ii) Calculate the root-mean-square (RMS) value of the potential difference.

Root-mean-square value ..... [2]

(d) Predict how the shape of the graph on the screen would change if both a diode and a capacitor were added to the circuit.

.....

..... [1]

[8]

For Examiner's Use

7 Ozone is found in both the upper and lower atmosphere.

(a) Distinguish between the effects of ozone in both the upper and lower atmosphere.

.....

.....

.....

..... [2]

(b) The concentration of ozone in the upper atmosphere was depleted due to the presence of CFC's (chlorofluorocarbons). In the lower atmosphere the very stable CFC's have no effect on ozone concentration.

(i) Explain why CFC's have no effect on lower level ozone concentrations.

.....

.....

.....

..... [2]

(ii) Describe the reactions that led to ozone depletion in the upper atmosphere.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(c) Ozone acts as a greenhouse gas.

Describe the effect of greenhouse gases on global temperatures and how this can affect the planet.

.....

.....

.....

..... [2]

[10]

SECTION B

Answer **one** Physics and **one** Chemistry question.
Write your answers on the answer sheet provided at the end of the booklet.

PHYSICS SECTION

1 Monochromatic light of wavelength 200 nm falls onto the clean metal plate of a negatively charged electroscope. The electroscope discharges.

(a) (i) Describe what causes the discharge of the electroscope. [1]

(ii) In another experiment light of the same frequency is incident on the cathode in an evacuated glass tube. The maximum kinetic energy of the electrons is measured as 2.73×10^{-19} J.

Calculate the minimum frequency of light that will cause the emission of electrons from the metal surface. ($h = 6.626 \times 10^{-34}$ Js; $c = 3.0 \times 10^{8}$ m/s) [4]

(b) The emission of electrons is explained using the particle nature of light, where the energy of light is quantised.

(i) State what is meant by the phrase *the energy of light is quantised*. [1]

(ii) Describe how this idea explains the frequency dependency of the emission of electrons from a metal. [3]

(c) Light is described as having a dual wave-particle nature.

(i) Give evidence of light showing wave nature. [2]

(ii) Electrons can also be described as having a dual wave-particle nature. Give evidence for electrons showing particle and wave behaviour. [2]

(d) Describe the production of monochromatic light by a laser. [7]

[20]

2 Incandescent light bulbs are made up of a tungsten filament in a glass bulb filled with an inert gas.

(a) (i) In terms of the kinetic particle theory explain the expansion of the tungsten filament as its temperature increases when switched on. [3]

(ii) Describe the transfer of heat through the filament. [3]

(iii) Suggest why the glass bulb gets hot. [1]

(iv) State why the bulb is filled with an inert gas. [1]

(b) Resistivity is an intrinsic property of a material that measures how strongly a given material opposes the flow of current.

(i) State the relationship between the resistance of the tungsten filament of a light bulb, its resistivity, length and cross-sectional area.
Do not give a formula. [3]

(ii) Describe a method to determine the cross-sectional area. [4]

(c) The resistivity of a semiconductor, like silicon, decreases with increasing temperature. Explain this in terms of bonding. [2]

(d) Diodes are semiconductor devices that are used for current rectification.

(i) Draw a simple circuit diagram including an a.c. power supply, a diode and a load. [2]

(ii) Sketch the trace observed on the screen of an oscilloscope connected across the load. [1]

[20]

CHEMISTRY SECTION

3 (a) Use s, p and d notation to show the electron configuration of a chloride ion. [2]

(b) Explain the change in radius when a chlorine atom changes into a chloride ion. [3]

(c) With the help of a dot and cross diagram explain how potassium chloride is formed from potassium and chlorine atoms. [3]

(d) Explain why the melting point of sodium chloride is higher than that of potassium chloride. [3]

(e) Explain why molten sodium chloride is a good conductor of electricity but not solid sodium chloride. [2]

(f) With reference to electrical conductivity, explain the difference between diamond and graphite. [3]

(g) A healthy diet includes milk. Milk can be up to 5% fat. Fat is a derivative of glycerol and fatty acids.

(i) Name and draw the link between glycerol and 3 fatty acids. [2]

(ii) Compare the structure of fat with terylene. [2]

[20]

4 (a) Describe the process of separating nitrogen from liquid air. [4]

(b) Give a reason why nitrogen gas is unreactive. Draw a molecule to support your answer. [2]

(c) (i) Name and discuss the process which uses nitrogen gas to manufacture ammonia. State the reaction conditions for this reaction and include the balanced chemical equation with the state symbols. [5]

(ii) Construct an equilibrium constant expression, K_c , for the reaction in **(c) (i)**, using symbols. [1]

(iii) The K_c for this reaction, at 673 K is 8.60. At the equilibrium there are 1.00×10^{-2} moles of ammonia and 1.00×10^{-2} moles of hydrogen in a 10 dm^3 flask at 673 K.

Calculate the concentration of nitrogen in the flask at equilibrium. [4]

(d) The formation of ammonia from nitrogen and hydrogen is an exothermic process. Explain how the K_c will change if the

(i) temperature is decreased, [2]

(ii) pressure is increased. [2]

[20]

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Answer sheets for Section B

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DATA SHEET
The Periodic Table of the Elements

Group																	
I	II											III	IV	V	VI	VII	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 †															

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

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

Key

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

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