EXAMINATIONS COUNCIL OF LESOTHO
Lesotho General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | | | | | | CANDIDATE NUMBER | | | | | | | | | |

PHYSICAL SCIENCE

Paper 2

0181/02
October/November 2018
1 hour 30 minutes
Marks: 80

310

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
A copy of the Periodic Table is printed on page 16.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

A008

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

1 **(a)** An object is dropped from the top of a building. The height of the building is 4 m high.

(i) State the force which pulls the object down.

..... [1]

(ii) Calculate the average speed of the object if it took 3 s to reach the ground.

speed = distance/time

average speed = ... [2]

(b) Fig. 1.1 shows a bicycle pedal which rotates the rear wheel during cycling.

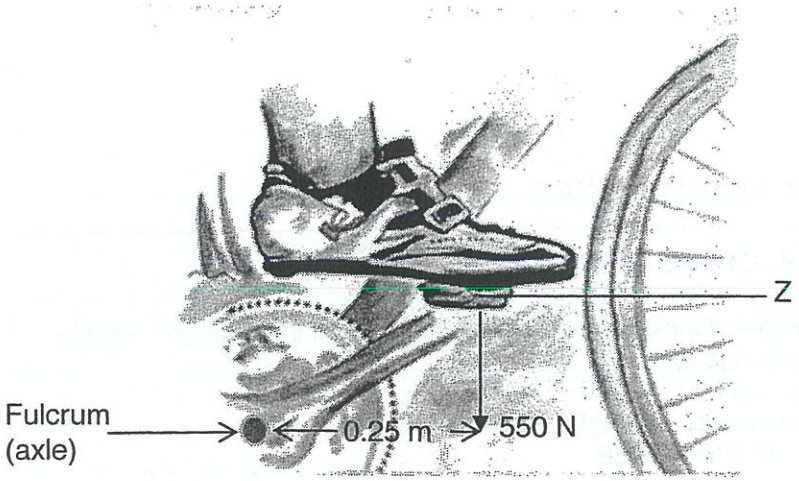

Fig. 1.1

A vertical force F, of, 55 N acts downwards on the pedal at Z. This causes it to rotate. The distance between Z and the axle is 0.25 m.

(i) Define the moment of a force.

.....

.....

.....

..... [2]

(ii) Calculate the moment of F about the axis of the pedal.

moment = ... Nm [2]

[Total: 7]

[Turn over

2 Figure 2.1 shows a set-up to heat water in a metal bucket using an immersion heater. Thermometers A and B are inserted at different levels into the bucket. They record the same temperature before the heater is switched on.

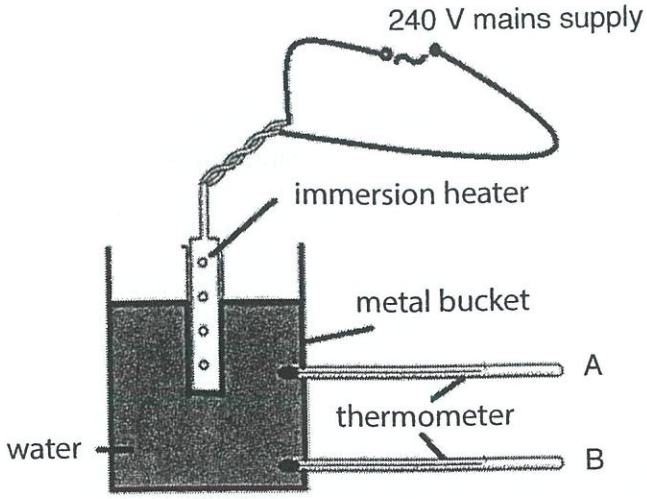

Fig. 2.1

(a) Describe how the thermal energy (heat) loss from the bucket can be reduced.

.....

..... [1]

(b) The immersion heater is switched on. After a while, the readings on the thermometers are different.

(i) State, with a reason, which thermometer is at a higher temperature.

.....

..... [1]

(ii) Identify the method of heat transfer involved in heating the water.

..... [1]

(iii) Explain, why the temperature in A is greater than in B.

.....

.....

.....

..... [3]

(c) The heater is connected to a 240 V mains supply to heat the water. An ammeter is connected into the circuit to measure current in the heater.

(i) On Fig. 2.2, complete the circuit to show how an ammeter is connected

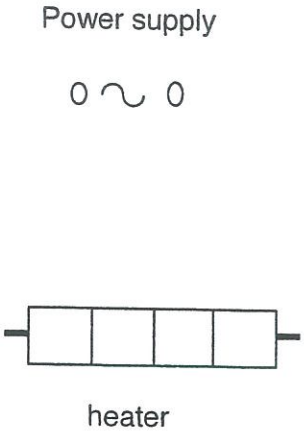

Fig. 2.2 [2]

(ii) Calculate the resistance of the heater when the current is 2.0 A.

Use $V = IR$.

resistance: ..... Ω [2]

[Total: 10]

3 **(a)** Fig. 3.1 shows a ray of light striking a glass block at an angle of 25°.
The refractive index, n, of glass is 1.5.

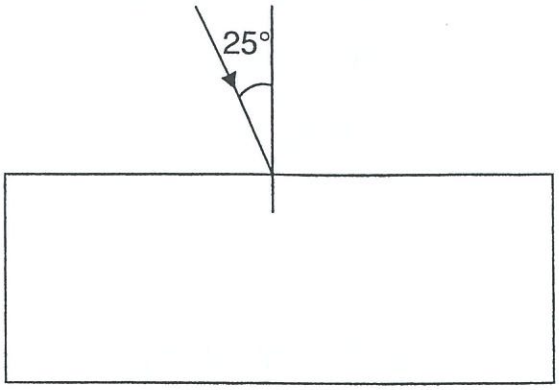

Fig. 3.1

(i) Calculate the angle of refraction, *r* in the glass block.

Use $n = \sin i / \sin r$

[2]

(ii) On Fig. 3.1, draw the refracted ray in the glass block. [2]

(b) Light is a wave.

State one other wave that travels at the speed of light in air.

..... [1]

(a) The frequency of a tuning fork is 600 Hz.

(i) Calculate the wavelength of the sound waves in centimetres.
(Use speed of sound in air as 330 m/s).

Use $v = f\lambda$

wave length = ... m [2]

(ii) The man beats the drum quietly, then more loudly.

Describe the change to the sound wave produced.

.....

..... [1]

[Total: 8]

[Turn over

4 **(a)** Plastic rod is rubbed with a woollen cloth. The rod becomes positively charged.

Explain how rubbing makes the rod positively charged.

.....

.....

.....

..... [2]

(b) Fig. 4.1 shows the positively charged rod placed near to a metal cap of an electroscope. The electroscope leaf deflected.

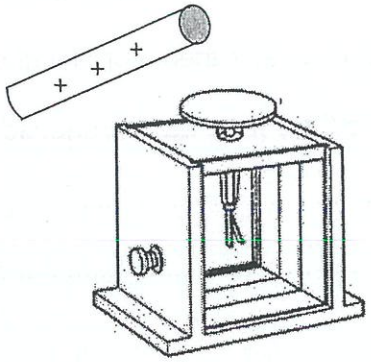

Fig. 4.1

(i) On Fig. 4.1 draw the distribution of charges on the metal cap and on the leaf. [2]

(ii) Explain why the leaf deflected.

.....

.....

.....

..... [2]

(c) Fig. 4.2 shows an 11 W fluorescent bulb supplied with 240 V.

11 W, 240 V

Fig. 4.2

(i) Explain why fluorescent bulbs are preferred to filament bulbs.

.....

..... [1]

(ii) State the energy change that takes place in the bulb.

.....

..... [2]

(iii) Calculate the current in the bulb when connected to a 240 V supply.

Use $P = IV$

current = ... [2]

[Total: 11]

5 A sample of radioactive carbon-14 decays by emitting beta-particles.

(a) State the nature of a beta-particle.

..... [1]

(b) Name a material that may be used to protect people from beta radiation.

..... [1]

(c) Complete the decay equation for carbon-14.

$$^{14}_{6}C \longrightarrow {}^{14}_{7}\quad\quad +{}^{}_{-1}\beta$$

[2]

[Total: 4]

6 Fig. 6.1 shows plants grown in a transparent plastic house and fed with a nutrient solution.

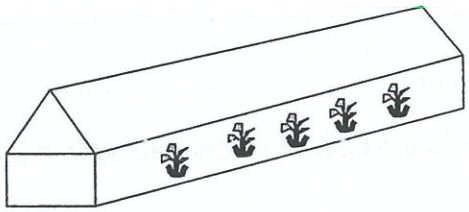

Fig. 6.1

(a) The plants in Fig. 6.1 produce carbohydrates by photosynthesis.

(i) Name the form of energy required for this process.

..... [1]

(ii) The word equation for photosynthesis is given below.

$$\text{Carbon dioxide} + \text{water} \xrightarrow[\text{chlorophyll}]{\text{light}} \text{glucose} + \text{oxygen}$$

State the type of reaction that describes photosynthesis.

..... [1]

(b) Table 6.1 shows the concentration of the ions in the nutrient solution used to feed the plants.

Table 6.1

element	ionic formula	common source	concentration in mg/L
nitrogen	NO_3^-	ammonium nitrate	200
phosphorus	PO_4^{3-}	potassium phosphate	40
potassium	K^+	potassium hydroxide	140

(i) The nutrient solution is always prepared just before the plants are fed as two of the common sources would react, leading to loss of one of the essential elements.

Identify the **two** common sources in table 6.1, and the element lost as they react.

common sources

1 .....

2 ..... [1]

element

..... [1]

(ii) Draw a labelled diagram of apparatus that could be used to demonstrate that the nutrient solution conducts electricity.

[3]

[Total: 7]

7 Fig. 7.1 shows how water from the well is treated for use at school.

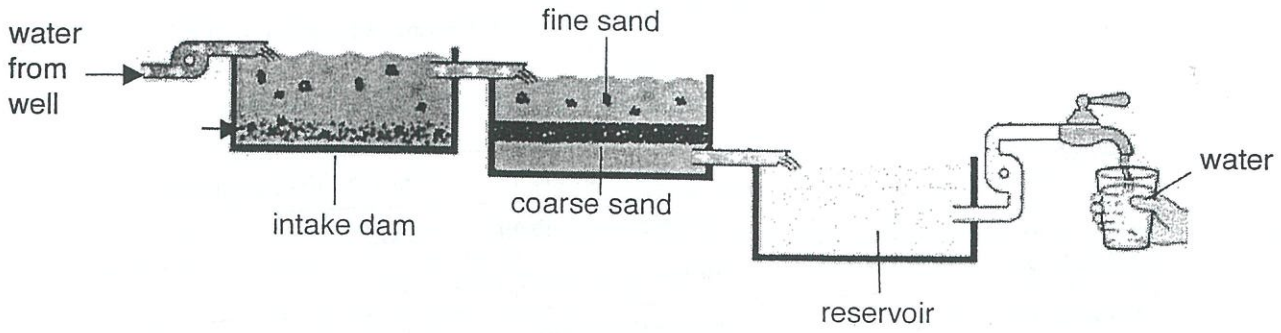

Fig. 7.1

(a) Suggest **one** reason why water should be treated before drinking.

.....

..... [1]

(b) **(i)** Explain why the water collected in the tank is impure.

.....

.....

.....

..... [1]

(ii) Describe a physical test for pure water.

.....

.....

.....

..... [1]

(c) Explain why some people prefer using rain water rather than water from the well for laundry.

.....

..... [1]

(d) State **one** way in which water can be conserved at schools.

.....

..... [1]

[Total: 5]

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8 A student performed an experiment to investigate how a reaction rate changes as the reaction progresses.

Excess dilute hydrochloric acid was reacted with 8 g of zinc granules.

(a) Fig. 8.1 is an **incomplete** diagram that represents the apparatus used.

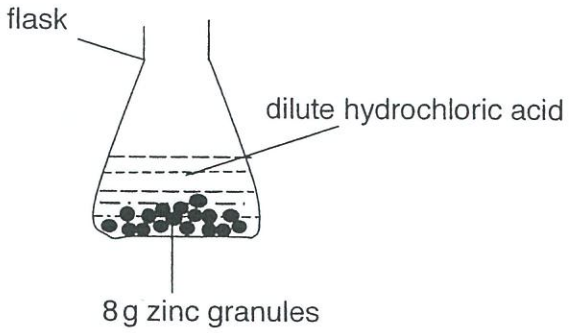

Fig. 8.1

(i) Name the gas produced in this experiment.

..... [1]

(ii) Describe the test and positive result for the gas named in (a) (i).

test .....

.....

positive result .....

..... [2]

(iii) Complete Fig. 8.1 to show how the gas produced could be collected and its volume measured. [2]

(b) Fig. 8.2 shows the sketch of the results obtained during the experiment.

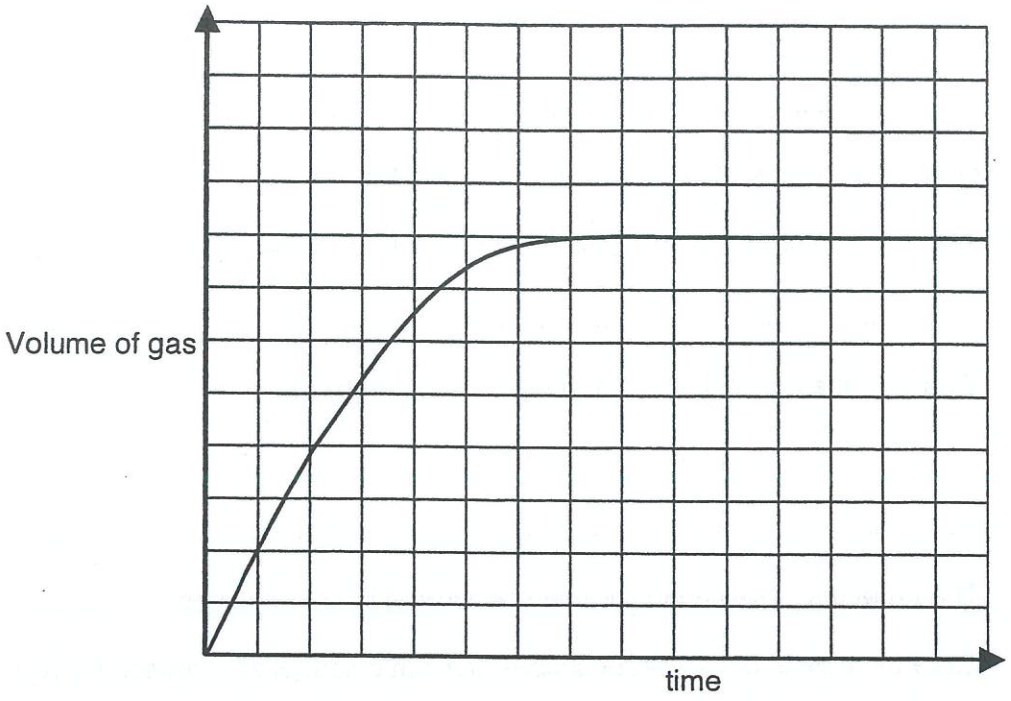

Fig. 8.2

(i) Name another piece of apparatus required to give the results in Fig. 8.2.

..... [1]

(ii) Use Fig. 8.2 to draw a conclusion from the investigation.

.....

..... [1]

(iii) In another experiment, the student used 4 g of the zinc granules.
All other conditions were kept the same as in the first experiment.

On Fig. 8.2, sketch a graph of the results that would be obtained. [2]

[Total: 9]

9 Lime (CaO) is manufactured industrially by thermal decomposition of limestone ($CaCO_3$) in a high temperature oven called a kiln.

(a) State **one** use of lime.

.....[1]

(b) Decomposition temperature in the kiln is around 1000 °C.

(i) Using this information, suggest a gas that is likely to be released from the lime factory.

.....[1]

(ii) Describe the harmful effect of the gas stated in (b) (i).

.....

.....[1]

(c) **(i)** The products produced in the manufacturer of lime are oxides.

State the type of oxide that describes calcium oxide. Give a reason for your answer.

type of oxide .....[1]

reason .....

.....[1]

(ii) Even at the higher temperature of the kiln, calcium oxide is still a solid but the product named in (b) (i) is a gas.

Explain this in terms of structure and bonding.

.....

.....

.....

.....

.....[3]

(iii) State the valency of calcium in lime.

.....[1]

(iv) Calculate the relative formula mass of limestone ($CaCO_3$).
Show your working.
(A_r: Ca; 40, C;12, O; 16)

..... [2]

(v) Calculate the percentage composition, by mass, of lime in limestone.

..... % [3]

[Total: 14]

10 Table 10.1 shows the molecular formulae and relative molecular masses of hydrocarbons **P**, **Q**, **R** and **S**.

compound	molecular formula	relative molecular mass
P	C_2H_4	28
Q	C_2H_6	30
R	C_3H_6	42
S	C_3H_8	44

Table 10.1

(a) Some of the hydrocarbons in table 10.1 belong to the same homologous series.

(i) State **two** compounds that are in the same homologous series.

.....

..... [1]

(ii) Name the homologous series to which the compounds stated in (a) (i) belong.

..... [1]

(b) One of the compounds in table 10.1 can be used to form a macromolecule called polythene.

(i) State the compound in table 10.1 used to form polythene.

..... [1]

(ii) Draw the graphical structural formula of the compound stated in (b) (i).

[2]

[Total: 5]

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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	209 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86
223 Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 †															

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	147 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	231 Pa Protactinium 91	238 U Uranium 92	237 Np Neptunium 93	244 Pu Plutonium 94	243 Am Americium 95	247 Cm Curium 96	247 Bk Berkelium 97	251 Cf Californium 98	252 Es Einsteinium 99	257 Fm Fermium 100	258 Md Mendelevium 101	259 No Nobelium 102	260 Lr Lawrencium 103

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

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

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

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