Candidate Name	Centre Number	Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

COMBINED SCIENCE 4003/2

PAPER 2 Theory

SPECIMEN PAPER N2020 2 hours

Additional materials:
Answer sheets
Calculator (Optional)
String
Graph paper (as per candidate's request)

The Periodic Table is provided on page 15.

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the spaces at the top.
Check if the booklet has all the pages and ask the invigilator for a replacement if it has missing pages.

Section A
Answer **all** questions.
Write your answers in the spaces provided on the question paper.
Section B
Answer any **two** questions.
Write your answers on the separate answer sheets provided.
Section C
Answer any **two** questions.
Write your answers on the separate answer sheets provided.
Section D
Answer any **two** questions.
Write your answers on the separate answer sheets provided.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question.

This question paper consists of 16 printed pages.

Section A

*Answer **all** the questions in the spaces provided.*

1. **(a)** State any **two** differences between inhaled and exhaled air.

1 .....

.....

2 .....

.....

[2]

(b) Transpiration is the loss of water through plant leaves.

(i) State any **one** advantage of transpiration to the plant.

.....

.....

[1]

(ii) State **one** disadvantage of excessive transpiration.

.....

.....

[1]

(iii) State any **two** factors which increase the rate of transpiration.

1 .....

.....

2 .....

.....

[2]

2. **(a)** Describe a natural ecosystem.

.....

.....

.....

[2]

(b) **(i)** Define the term *balanced diet*.

.....

.....

.....

[2]

(ii) Describe the importance of calcium to a pregnant woman.

.....

.....

.....

[2]

(iii) State the advantage of eating liver.

.....

.....

.....

[1]

3. **(a)** Chlorine gas has two types of atoms as shown:

$$^{35}_{17}Cl \quad and \quad ^{37}_{17}Cl$$

(i) State the name given to the two types of the chlorine atoms.

.....

[1]

(ii) Calculate the number of neutrons in $^{35}_{17}Cl$.

.....

[1]

(b) Chlorine reacts with sodium to form sodium chloride, NaC*l*.

(i) Name the type of bonding in sodium chloride.

.....

[1]

(ii) Draw a dot and cross diagram to show the bonding in sodium chloride.

[2]

c) State any **two** physical properties of sodium chloride.

1 .....

2 .....

[2]

4. **(a)** Indigestion is caused by too much dilute hydrochloric acid in the stomach. It is cured by ingesting anti-acid tablets.

State, with a reason, the acid-base nature of the chemical present in the anti-acid tablets.

acid-base nature .....

reason .....

.....

[2]

(b) **(i)** Iron is extracted from an iron compound found in haematite.

Name the iron compound in haematite.

.....

[1]

(c) Two other solid raw materials are fed into the blast furnace together with haematite. Name the **two** raw materials and state a function for each of these materials.

raw material .....
function .....
raw material .....
function .....

[4]

5. (a) **Fig.5.1** shows a stroke in the operation of an engine.

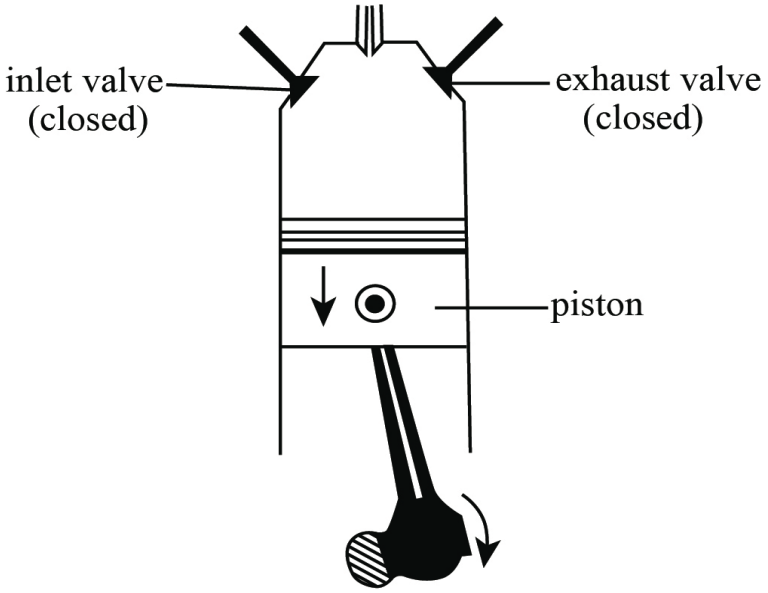

Fig.5.1

(i) Identify, giving **two** reasons, the stroke shown.

stroke .....
reasons: 1 .....
.....
2 .....
.....

[3]

(b) State the role of a fuel injector in a petrol engine.

.....

.....

.....

[1]

(ii) State the role of a carburettor.

.....

.....

[1]

(iii) Explain the advantage of a fuel injector over a carburettor.

.....

.....

.....

[2]

6. **Fig.6.1** shows part of the design of a solar water heater.

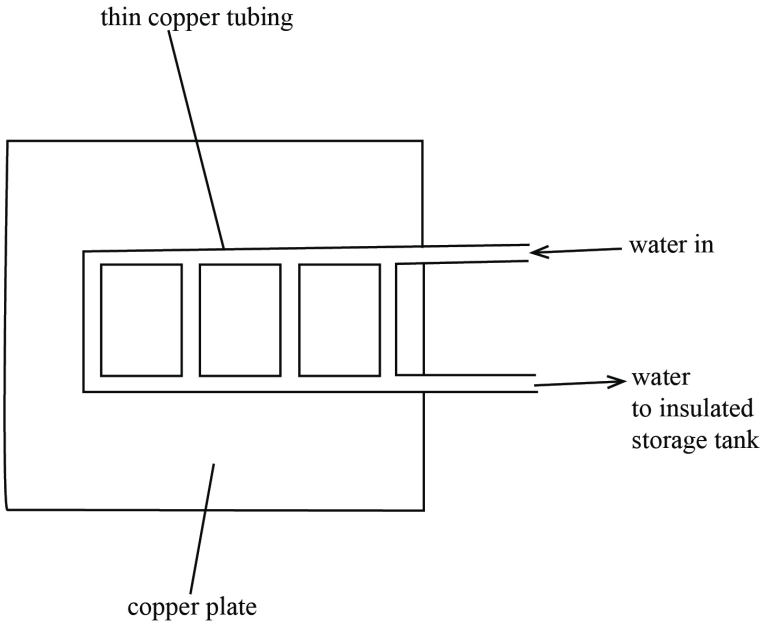

Fig.6.1

(a) State, with a reason, the most suitable place for placing the solar water heater for best results.

place .....

reason .....

.....

[2]

(b) State, with a reason, the paint colour on the copper plate.

colour .....

reason .....

[2]

(c) Explain why

(i) a thin copper tubing is used, ...

.....

(ii) the storage tank is insulated. .....

.....

[2]

Section B

*Answer any **two** questions on the separate answer sheets provided.*

7. (a) **Fig.7.1** shows a sketch diagram to represent double circulation in mammals.

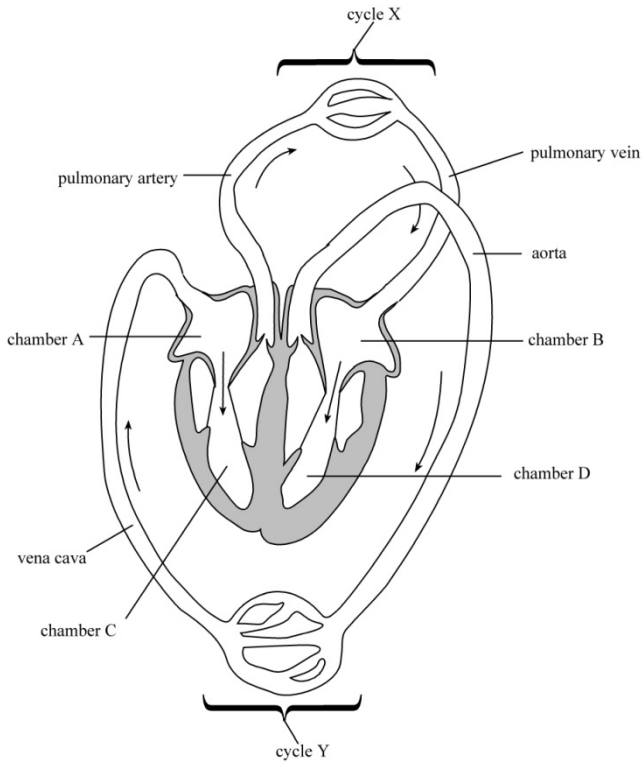

Fig.7.1

(i) Deduce the types of circulation represented by cycles X and Y. [2]

(ii) Suggest the reason for differences in the thickness of the walls of chambers C and D. [2]

(iii) State any **three** symptoms of malaria. [3]

(iv) State a symptom of ebola which is different from symptoms of malaria. [1]

(v) State any **two** effects of inhaling glue. [2]

8. **(a)** **Fig.8.1** shows a child suffering from a deficiency disease.

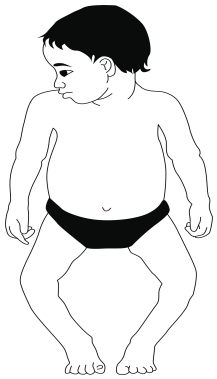

Fig.8.1

(i) Name the deficiency disease which the child is suffering from. [1]

(ii) Describe how the disease named in **(i)** could be prevented. [2]

(b) Describe the route of the sperm from the testis to the oviduct. [4]

(c) State **one** advantage of using condoms during sexual intercourse. [1]

(d) Define the term *fertilisation.* [2]

9. **(a)** **Fig.9.1** shows gaseous exchange in the alveolus of a mammal.

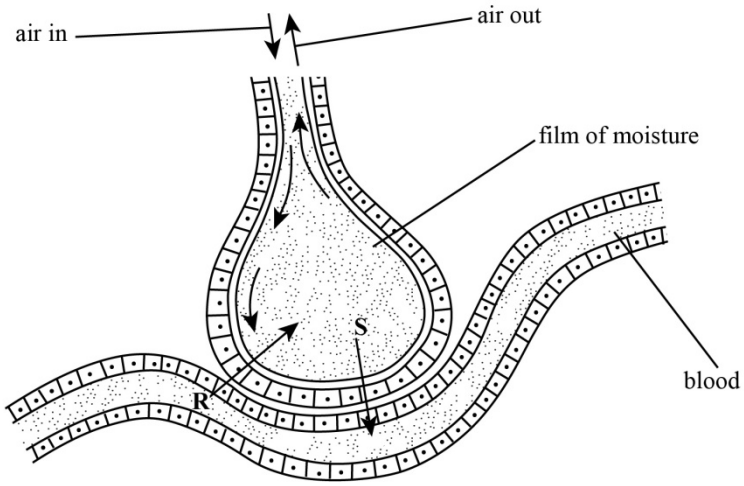

Fig.9.1

(i) Name the gases moving in the directions shown by the arrows **R** and **S**. [2]

(ii) Describe and explain how the alveolus is adapted for gaseous exchange. [4]

(b) Define the terms *plasmolysis* and *turgidity*. 4]

Section C

*Answer any **two** questions on the separate answer sheets provided.*

10. **(a)** **(i)** Define the term *atom*. [1]

(ii) State the **two** sub-atomic particles found in the nucleus of an atom. [2]

(b) Determine the empirical formula of a compound made up of 75% by mass carbon and 25% by mass hydrogen. [4]

(c) Sodium hydroxide solution reacts with dilute nitric acid acid to form a salt and water.

(i) State the type of reaction that occurs. [1]

(ii) Determine the chemical formula of the salt. [2]

11. **(a)** Outline the stages involved in the extraction of nitrogen from liquid air. [4]

(b) Oxygen can be obtained from the electrolysis of acidified water.

(i) Name the acid used to acidify the water. [1]

(ii) Explain why the water is acidified. [2]

(iii) Explain why the volume of oxygen obtained during the electrolysis process is half that of hydrogen. [2]

(iv) State any **one** use of oxygen. [1]

12. **Fig.12.1**shows the production of sulphuric acid by the contact process.

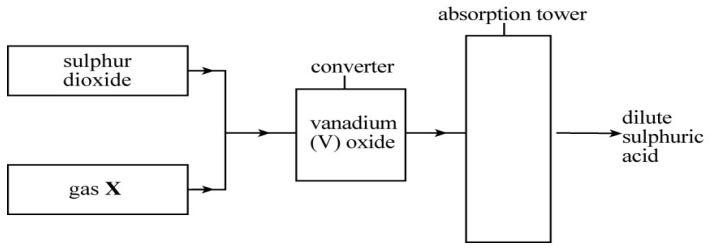

Fig.12.1

(a) **(i)** Name gas **X**. [1]

(ii) State the role of vanadium (V) oxide. [1]

(iii) Explain why sulphur trioxide is **not** directly added to water. [2]

(iv) Define the terms *exothermic* and *reversible*. [2]

(v) Name the substance which is formed in the absorption tower. [1]

(b) Ammonium sulphate, $(NH_4)_2SO_4$, is a fertilizer produced from sulphuric acid.
Calculate the percentage composition by mass of nitrogen in ammonium sulphate. [3]

Section D

*Answer any **two** questions on the separate answer sheets provided.*

13. (a) **Fig.13.1** shows an alternating current (a.c) generator.

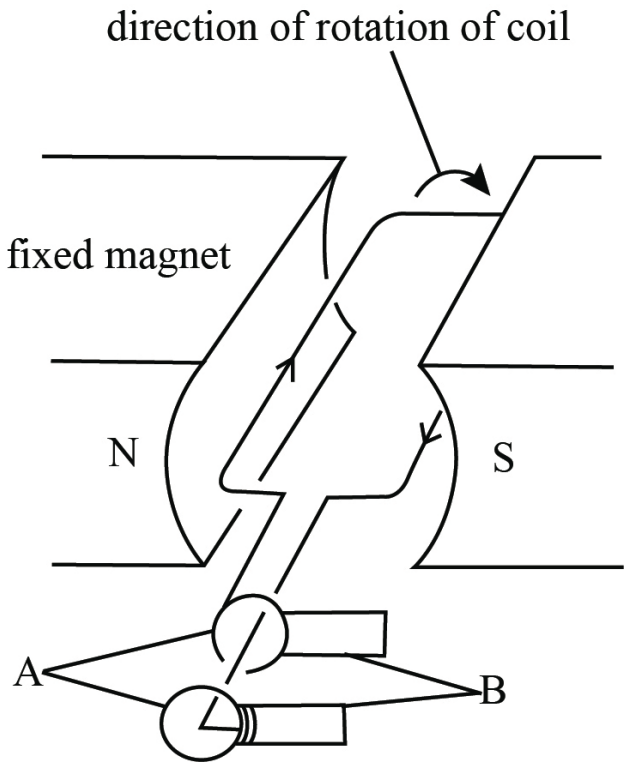

Fig.13.1

(i) Name the parts labelled **A** and **B.** [2]

(ii) Describe how the a.c. generator produces electricity. [4]

(iii) Sketch a graph of output voltage of the generator against time. [2]

(b) Explain the effect of using stronger magnets on the magnitude of the output voltage. [2]

14. **(a)** A gear system has ten teeth in the driving gear and thirty teeth in the driven gear.

(i) Calculate the velocity ratio, VR, of the gear system. [2]

(ii) Determine the efficiency of the system if its mechanical advantage, MA, is 2. [2]

(iii) Give any **two** reasons why the efficiency of a machine is always less than 100 %. [2]

(iv) State any **two** ways by which the efficiency of a machine can be improved. [2]

(b) State any **two** types of machines apart from gears. [2]

15. **(a)** Describe how electricity is generated at a thermal power station. [4]

(b) State any **two** disadvantages of using coal as a source of fuel for a thermal power station. [2]

(c) Give the main difference between a thermal power station and a hydroelectric power station. [2]

(d) State the type of energy possessed by water which is in a dam. [1]

(e) State the Standard International (S.I) unit of energy. [1]

DATA SHEET
The Periodic Table of the Elements

Group																	
I	II										III	IV	V	VI	VII	O
							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 Sulphur 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 Einstenium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103

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

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

The volume of one mole of any gas is 28 dm^3 at room temperature and pressure (r.t.p.)

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