



ZIMBABWE

**MINISTRY OF HIGHER AND TERTIARY EDUCATION,
INNOVATION, SCIENCE AND TECHNOLOGY
DEVELOPMENT**

**HIGHER EDUCATION EXAMINATIONS COUNCIL
(HEXCO)**

NATIONAL DIPLOMA

IN

ENVIRONMENTAL HEALTH

SUBJECT: Physical Science

**PAPER NO: 605/15/S05
605/21/S05**

DURATION: 3 hours

NOVEMBER/DECEMBER 2025 EXAMINATION

REQUIREMENTS

Pencil, eraser, scientific calculator, periodic table, graph paper

INSTRUCTIONS TO CANDIDATE

- 1) Answer all questions from section A.
- 2) Answer one (1) question from section B.
- 3) Take acceleration to gravity (g) = 9.8m/s^2 .
- 3) Answer 1 question from section C.

This paper consists of 5 printed pages.

SECTION A

QUESTION 1

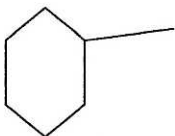
a) Name the following compounds:

i) $CH_3CH_2CH_3$ (1 mark)

ii) $CH_3CH = CHCH_3$ (1 mark)

iii) $CH_3CH(OH)CH_2CH_3$ (1 mark)

iv) $CH_3CH_2CH_2OH$ (1 mark)

v)  (1 mark)

vi) $CH_3CH_2CH(CH_3)CH_2CH = CCH_3CH_3$ (1 mark)

a) i) Differentiate between a primary and a tertiary alcohol, give a typical example in each case. (4 marks)

ii) Name the process by which sugars are converted into alcohols. (1 mark)

b) What mass of oxygen is needed to react with 5.95 grams of Ammonia. (4 marks)

c) What are polar compounds? Give an example of a polar compound. (4 marks)

d) Define mole. (1 mark)

QUESTION 2

a) Explain the concept of heat transfer under the following:

i) Conduction (4 marks)

ii) Radiation (4 marks)

iii) Convection (4 marks)

- b) Outline the principle of operation of a lift pump. State the role played by atmospheric pressure in the pumping process. (8 marks)

QUESTION 3

- a) Balance the following equations:
- $H_2SO_{4(aq)} + NaOH_{(aq)} \rightarrow H_2O_{(l)} + NaSO_{4(aq)}$ (3 marks)
 - $H_3PO_{4(aq)} + NaOH_{(aq)} \rightarrow H_2O_{(l)} + Na_3PO_{4(aq)}$ (3 marks)
 - $Al(OH)_{3(s)} + HCl_{(aq)} \rightarrow AlCl_{3(aq)} + H_2O_{(l)}$ (3 marks)
 - $HNO_{3(aq)} + Mn(OH)_2 \rightarrow H_2O_{(l)} + Mn(NO_3)_{2(aq)}$ (3 marks)
 - $AgNO_{3(aq)} + NaCl_{(aq)} \rightarrow y + NaNO_{3(aq)}$ (3 marks)
- b) What is the oxidation number of manganese (Mn) in $KMnO_4$? Show your working. (3 marks)
- c) Given the following reaction find the masses of oxygen and sulphur dioxide, formed from 3g of sulphur, x and yg. (2 marks)



SECTION B

QUESTION 4

- a) Discuss the ion exchange process as used to soften hard water with the aid of relevant equations where necessary. (10 marks)
- b) Outline any four (4) uses of oxygen gas. (2 marks)
- c) In a titration $25cm^3$ of a solution of NaOH of concentration 0,1M needed $24,8cm^3$ of H_2SO_4 for neutralisation. The following reaction takes places.
- $$H_2SO_{4(aq)} + 2NaOH_{(aq)} \rightarrow Na_2SO_{4(aq)} + 2H_2O_{(l)}$$
- Determine the concentration of $H_2SO_{4(aq)}$ (4 marks)
- d) Explain how the following bonds are made in each case, give a typical example to illustrate your answer:
- Covalent bond. (2 marks)
 - Ionic bond. (2 marks)

QUESTION 5

- a) i) With an example of each distinguish between a basic and derived SI unit. (2 marks)
- ii) State the difference between a scalar and a vector quantity giving examples in each case. (4 marks)
- b) A body is thrown vertically upwards at 40m/s sketch a velocity- time graph for the time of flight (in the air). (3 marks)
- c) An eagle flies 1500m from its nest east to a baobab tree, then 2km south to a hill. Use a diagram to determine the displacement of the eagle. (6 marks)
- d) i) State Newtons second law and show how this law can be used to define force. (4 marks)
- ii) Distinguish between force and pressure. (1 mark)

SECTION C

QUESTION 6

- a) A student claims that a 500kg car travelling at 10m/s has twice the kinetic energy of a 500kg car travelling at 5m/s. Show that this claim is incorrect. (6 marks)
- b) State the difference between a longitudinal and transverse wave. Give examples of each. (4 marks)
- c) i) Explain how simple machines such as levers and pulleys make work easier. (3 marks)
- ii) A 50kg bag of maize is raised 0,2 metres by a machine in which an effort of 150N moves through a distance of 1.0 metres. Calculate the efficiency of the machine. (7 marks)

QUESTION 7

- a) State Hooke's law. (2 marks)
- b) A boy walks 4km to the North and turns, walks 3km east. Draw the resultant force and show the magnitude. (4 marks)

- c) The efficiency of a machine is 80% and a load of 100N is raised 1m when the effort (f) moves 5 metres in its own direction. Calculate:
- i) Work obtained from the machine in joules. (2 marks)
 - ii) Effort (f) (3 marks)
 - iii) Mechanical advantage (2 marks)
- d) i) Use the screw and Jack to raise a large rock with a mass of 35kg. What is the mechanical advantage if the effort is 200N. (3 marks)
- ii) What is the velocity ratio if the rock was raised 1 metre and effort moved 3 metres. (2 marks)
- e) State Ohm's law. (2 marks)

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