ZIMBABWE

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

HIGHER EDUCATION EXAMINATIONS COUNCIL (HEXCO)

NATIONAL DIPLOMA

IN

ENVIRONMENTAL HEALTH

MODULE: Physical Science for Environmental Health Technicians

PAPER NO: 605/23/M12

DURATION: 3 hours

MAY/JUNE 2025 EXAMINATION

REQUIREMENTS

1. Non-programmable scientific calculator
2. Graph paper
3. Periodic table
4. Pencil, ruler

INSTRUCTIONS TO CANDIDATE

1. Answer any five (5) questions.
2. Each question carries 20 marks.
3. Take value of $g = 9.81 m/s^2$.
4. Do not write your name on the answer booklet.

This paper consists of 5 printed pages.

PAPER NO: 605/23/M12 – PHYSICAL SCIENCE FOR ENVIRONMENTAL HEALTH TECHNICIANS

QUESTION 1

a) Define the following terms, giving its SI unit:

i) Mass (2 marks)
ii) Inertia (2 marks)
iii) Weight (2 marks)
iv) Density (2 marks)
v) Momentum (2 marks)

b) State Newton's third (3^{rd}) law of motion. (2 marks)

c) A 50kg bag of cement is raised 0.2m by a machine in which an effort of 150N moves through a distance of 1m. Calculate the mechanical advantage. (4 marks)

d) Assuming a unit of electricity costs 8ZIG. Calculate the cost of burning an electric stove at 8000W for 4 hours. (4 marks)

QUESTION 2

a) A 12V battery is connected in series with a 3Ω resistor and two (2) resistors of 2Ω and 4Ω are connected in parallel to each other.

i) Draw the circuit diagram to show their connections. (4 marks)
ii) Calculate the total resistance in the circuit. (3 marks)
iii) Calculate the current supplied by the battery. (3 marks)

b) Discuss any five (5) health problems associated with exposure to radioactive materials in hospitals. (10 marks)

QUESTION 3

a) A car starts from rest and reaches a velocity of 72km/h in 15 sec, then travels at a constant velocity for 30 sec. The car is then uniformly retarded so that it comes to a rest over a displacement of 50m.

i) What is the displacement in the first 15 seconds? (3 marks)
ii) What is the acceleration in the last 50m? (3 marks)
iii) If the mass of the car is 120kg what is the average retarding force? (3 marks)

b) i) Sketch the velocity-time graph for the car. (5 marks)

ii) Hence use the graph in b(i) above to determine displacement. (4 marks)

c) Explain what happens to the kinetic energy of the car when it is brought to rest. (2 marks)

QUESTION 4

a) Define the following terms, giving an example for each:

i) Isotope(s) (2 marks)
ii) Atom(s) (2 marks)
iii) Element(s) (2 marks)

b) Identity any two (2) alkalines used in hospitals and give one medical use for each. (4 marks)

c) Balance the following equations:

i) $Na_2CO_3 + HNO_3 \rightarrow NaNO_3 + H_2O + CO_2$ (2 marks)
ii) $Mg(OH)_2 + HNO_3 \rightarrow Mg(NO_3)_2 + H_2O$ (2 marks)
iii) $Na_2O + H_2O \rightarrow NaOH$ (2 marks)

d) Explain oxidation and reduction in terms of electron transfer and give two (2) examples of redox reactions. (4 marks)

QUESTION 5

a) i) State one use of oxygen in medicine and one use in the industry. (2 marks)

ii) Heartburn/acid reflux occurs when stomach acid flows back into the esophagus. State the acid that cause the burning sensation and explain how heart burn can be prevented. (5 marks)

b) Draw dot and cross diagrams for the following compounds/molecules used in hospitals.

i) Water (3 marks)
ii) Ammonia (3 marks)
iii) Nitrogen (3 marks)
iv) Salt (4 marks)

QUESTION 6

a) Give the functional group for the following:

i) Alkanes (2 marks)
ii) Alkenes (2 marks)
iii) Alkynes (2 marks)
iv) Alcohol (2 marks)

b) 85.72g of carbon combines with 14.28g of hydrogen. If the relative formula mass of the compound is 28, what is its formula? Show all steps followed to derive the formula. (10 marks)

c) State any two (2) impacts of heavy metals on the environment and human health. (2 marks)

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