Cambridge Aligned Lower Secondary Science: Density and Energy Practice Test

Name:_____ Date:_____

Time allowed: 30 minutes | **Total marks:** 20 marks

> Read each question carefully. Show all working for calculation questions and state the correct units.

Section A: Density and Measurement [10 marks]

1. Density is a physical property of matter.

a) State the formula used to calculate density. [1]

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b) Explain why density is classified as a **derived quantity** rather than a fundamental (base) quantity. [1]

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2. A student investigates the volume of two solid objects, **A** and **B**.

a) Object **A** is a wooden cube with sides of length 3.0 cm. Calculate the volume of Object **A**. [1]

b) Object **B** is an irregular stone. The student measures its volume using the water displacement method shown in the diagram.

i. State the volume of the stone. [1]

ii. Explain why a ruler cannot be used to find the volume of Object **B**. [1]

3. A metal block has a mass of 160 g and a volume of 20 cm^3.

a) Calculate the density of the metal block. State the unit in your answer. [2]

b) The density of pure water is 1.0 g/cm^3. State whether this metal block will **float** or **sink** in water. Give a reason for your answer. [1]

4. Using particle theory, explain why gases have much lower densities than solids. [2]

Section B: Conservation and Transformation of Energy [10 marks]

5. State the **Law of Conservation of Energy**. [1]

6. Complete the table to identify the energy input, useful energy output, and wasted energy output for each device. [3]

Electric Motor	Electrical	Kinetic	
Car Engine		Kinetic	Thermal and Sound

Device	Energy Input	Useful Output	Wasted Output
Filament Lamp	Electrical		Thermal

7. A television transfers 250 J of electrical energy. It produces 70 J of light energy and 80 J of sound energy. The remaining energy is transferred as thermal energy to the surroundings.

a) Calculate the amount of wasted thermal energy produced by the television. [1]

b) What is the total useful energy output of the television? [1]

8. Energy that spreads out into the surroundings is described as **dissipated energy**.

a) Explain what happens to dissipated energy and why it cannot easily be used again. [1]

b) A student says: "When thermal energy dissipates from a hot engine, that energy is destroyed." Explain why the student is incorrect. [1]

9. Describe the difference between an **energy transfer** and an **energy transformation**. Give one example of each. [2]

Answers

1. a) Density = Mass ÷ Volume (or D = M / V) [1 mark]

1. b) It cannot be measured directly with a single instrument and is calculated by combining two base quantities: mass (fundamental) and length/volume (derived). [1 mark]

2. a) Volume = length × width × height = 3 cm × 3 cm × 3 cm = 27 cm^3 [1 mark]

2. b) i. Volume = 52 cm^3 - 35 cm^3 = 17 cm^3 [1 mark]

2. b) ii. An irregular object has an uneven shape, so its dimensions cannot be measured accurately using a formula or ruler. [1 mark]

3. a) Density = Mass ÷ Volume = 160 g ÷ 20 cm^3 = 8 g/cm^3 (or 8.0 g/cm^3) [1 mark for correct calculation, 1 mark for correct unit: g/cm^3]

3. b) It will sink because its density (8 g/cm^3) is greater than the density of water (1.0 g/cm^3). [1 mark]

4. In solids, particles are tightly packed together in fixed positions with very small spaces between them [1 mark]. In gases, particles are spread far apart from each other, resulting in very little mass in a given volume [1 mark].

5. Energy cannot be created or destroyed; it can only be transferred or transformed from one form to another. [1 mark]

6. Filament Lamp Useful Output: Light [1 mark]; Electric Motor Wasted Output: Thermal / Sound (accept Heat) [1 mark]; Car Engine Input: Chemical [1 mark].

7. a) Total input = Useful output + Wasted output: 250 J = (70 J + 80 J) + Thermal energy. Thermal energy = 250 - 150 = 100 J. [1 mark]

7. b) Total useful output = 70 J + 80 J = 150 J. [1 mark]

8. a) Dissipated energy spreads out into the surrounding environment and becomes less concentrated / less useful. [1 mark]

8. b) According to the law of conservation of energy, energy can never be destroyed, only spread out into thermal stores in the air/surroundings. [1 mark]

9. Energy transfer: energy moves from one object to another as the same form of energy (e.g., thermal energy conduction from hot tea to a cup, or kinetic energy passed from one billiard ball to another) [1 mark]. Energy transformation: energy changes from one type/form to a different type (e.g., electrical energy turning into light energy in a bulb, or chemical energy into kinetic energy in an engine) [1 mark].