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]

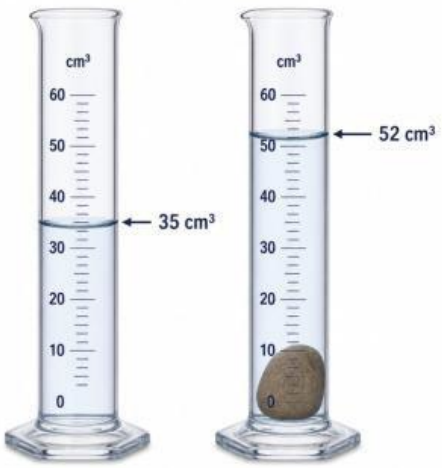
**1.** Density is a physical property of matter.

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

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

**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]



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

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**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]

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**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]

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

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

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

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**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]



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



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## 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].



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