



CHEMISTRY 2.4

JPC Practice paper

Describe the nature of structure and bonding in different substances and thermodynamic

Credits: Four

INSTRUCTIONS

Answer **ALL** questions.

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You should aim to spend about 60 minutes on this assessment

QUESTION ONE: Lewis Diagrams and Shapes of Molecules

- (a) Complete the table below by:
- drawing the Lewis Structure for the molecules
 - drawing a diagram and giving the name for the shape of each molecule

| Molecule | Lewis Structure | Diagram showing shape | Name of shape |
|------------------|--|-----------------------|---------------|
| SO ₂ | $\text{:}\ddot{\text{O}}\text{--}\ddot{\text{S}}\text{=}\ddot{\text{O}}\text{:}$ | | Bent |
| PH ₃ | $\text{H--}\ddot{\text{P}}\text{--H}$ H | | |
| CCl ₄ | | | |
| H ₂ S | | | |

- (b) Justify your answers for the shapes of the last three molecules.

PH₃ _____

CCl₄ _____

H₂S _____

QUESTION THREE: Types of solids

(a) Complete the table by:

(i) classifying substances B to E as: **ionic**, **metallic**, **molecular** or **covalent network**.

(ii) choosing an example for substances A to E chosen from:

iodine (I₂), silicon dioxide (SiO₂), barium chloride (BaCl₂), Copper (Cu), Nitrogen gas

(N₂)

| Substance | Melting point (°C) | Conductivity | Hardness of solid | Classification | Example |
|-----------|--------------------|---|-------------------|----------------|---------|
| A | 963 | conducts when molten but not when solid | brittle | ionic | |
| B | 1085 | high | malleable | | |
| C | -210 | none | Soft | | |
| D | 1713 | none | hard | | |
| E | 114 | none | Soft | | |

(b) (i) Account for the brittleness of substance **A**

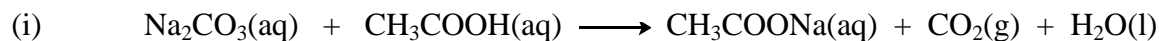
(ii) Account of the malleability of substance **B**

(iii) Account for the difference in conductivity between substances **A** and **B**

QUESTION FIVE

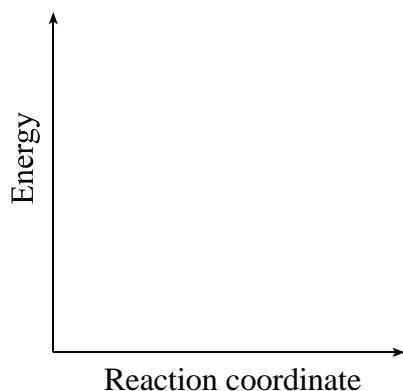
(a) For each reaction below:

- draw an energy diagram;
- state whether the test tube would feel warmer or cooler
- describe the reaction as endothermic or exothermic.
- **Justify your answers**



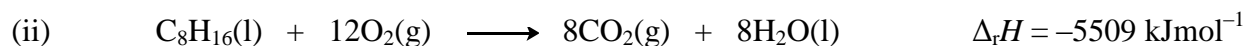
$$\Delta_r H = +151 \text{ kJmol}^{-1}$$

Energy Diagram

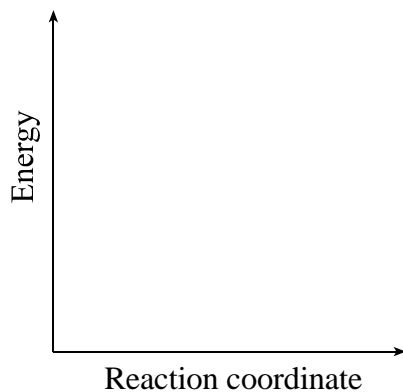


- The test tube would feel _____
- This reaction is _____

Justification : _____



Energy Diagram



- The test tube would feel _____
- This reaction is _____

Justification : _____

QUESTION SIX

A laboratory technician adds 43.1 mL of 11.6 mol L⁻¹ hydrochloric acid to water to form 500 mL of solution. The temperature of the solution rises 2.6 °C.

- (i) Calculate the energy change for the reaction

$$c = 4.18 \text{ kJ g}^{-1} \text{ °C}^{-1}$$

- (ii) Calculate $\Delta_r H$ for dissolving one mole of the hydrochloric acid in water.
