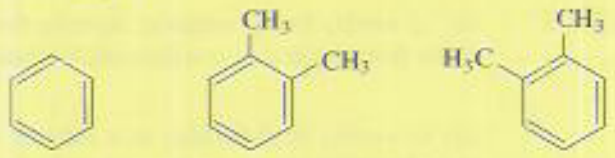
SECTION A
Short-answer questions

Attempt **TEN** *of the twelve questions in this Section. All questions carry equal marks.*

This Section carries 30 per cent of the total marks for the examinable component. You are advised to spend no more than **60 minutes** *on this Section. Write your answers in a separate answer book from those used for Sections B, C and D.*

Question 1 The atomic number of silicon is 14. Represent the ground-state electronic configuration of the silicon atom as a box diagram, by inserting arrows into *the boxes printed on the green* Answer Sheet *that accompanies this examination paper.*

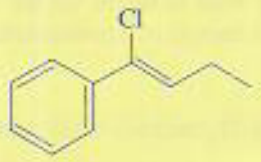
Question 2 The structural formula of the benzene molecule, C_6H_6, is often written as **1**. This suggests that when two methyl groups are substituted for adjacent hydrogen atoms on the benzene ring of **1**, two different products, **2** and **3**, are possible. In fact, only one such product is known. Explain this discrepancy.



1 **2** **3**

Question 3 Using diagrams, describe what is meant by 'close-packing' in the crystal structure of metals.

Question 4 Give the systematic name of Compound **4**, including its stereochemical designation. Provide brief details of how you assigned the systematic name.



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Question 5 Table 1 gives thermodynamic data at 298.15 K for the elements tin and hydrogen, and their aqueous ions.

Table 1 Thermodynamic data at 298.15 K for the elements tin, hydrogen and their aqueous ions

Substance	State	$\Delta H_f^\ominus$ / kJ mol^{-1}	$\Delta G_f^\ominus$ / kJ mol^{-1}	$S^\ominus$ / J K^{-1} mol^{-1}
Sn	s	0	0	51.6
Sn^{2+}	aq	−8.8		−17.0
H_2	g	0	0	130.7
H^+	aq	0	0	0

(*a*) (*1 mark*) Write down the formation reaction for Sn^{2+}(aq). Include state symbols.

(*b*) (*4 marks*) Calculate the value of $\Delta G_f^\ominus$ (Sn^{2+}, aq), which is missing from Table 1.