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Abbreviations, annotations and conventions used in the Mark Scheme	/ = alternative and acceptable answers for the same marking point ; = separates marking points NOT = answers which are not worthy of credit ( ) = words which are not essential to gain credit ____ = (underlining) key words which **must** be used to gain credit ecf = error carried forward AW = alternative wording ora = or reverse argument

Question	Expected Answers	Marks
1	**(a)** Solid consists of regular arrangement of particles (1) Energy causes these to vibrate more disrupting arrangement (1) Liquid has similar density, but irregular arrangement of particles that can move whilst maintaining const. vol. (1) Energy sufficient to disrupt van der Waals' forces holding the lattice together. (1)	**Any 3**
	(b) (i) Any noble gas (1)	**1**
	(ii) High temp (1) low pressure (1) Energy of particles overcomes intermolecular forces (1) Large distances between particles means intermolecular forces are negligible / vol of particles is negligible (1)	**4**
	(c) (i) $pV=nRT$ (1)	**1**
	(ii) $pV=nRT = \frac{mRT}{M_r}$ (1) hence $M_r = \frac{mRT}{pV}$ $M_r = \frac{0.180 \times 8.31 \times 373}{100\,000 \times 7.70 \times 10^{-5}} = 72(.5)$ (2) Alternatives possible here from calcn of volume	**3** **Total : 12**

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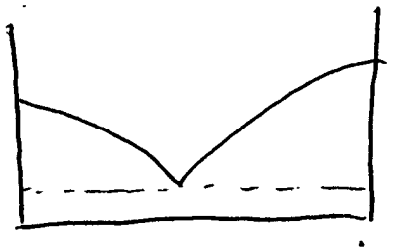
Question	Expected Answers	Marks
2	**(a) (i)** Correct shape (as shown) (1)	
		
	3 m.p.s used (quoted from qn) (1) 3 areas labelled (liquid, solid + 1 mixture) (1)	**3**
	(ii) Eutectic (1)	**1**
	(iii) A Liquid cooling (1) **B** Solid silver begins to separate (1) **C** Mixture solidifies (1) **D** Solid (mixture) cools (1)	**4**
	(iv) There would only be one point of inflection (1) (or equiv) The eutectic has a single fixed melting point (1) (or sketch)	**2**
		Total : 10

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Question	Expected Answers	Marks
3	**(a) (i)** Molecules have enough energy to overcome weak bonds in the liquid reducing solubility of the gases (1)	**1**
	(ii) Ammonia forms H-bonds with water / Ammonia reacts with water (1) Dipole diagram or desc / Allow $NH_3 + H_2O = NH_4^+ + OH^-$ (1)	**2**
	(iii) Higher pressure forces more gas molecules into the liquid. / gas more soluble at high pressure + Opening releases the pressure and gas escapes (1)	**1**
	(b) (i) The distribution of a solute between two solvents or description (1)	**1**
	(ii) Partition coeff = $\frac{\text{Concn of product in water}}{\text{Concn of product in ethoxyethane}}$ Allow inverse $= \frac{0.25}{1.25} = 0.2$ (or 5 if inverted) (1)	**1**
	(iii) Total amount of product = 1.5 g (1) First extraction : $0.2 = \frac{(1.5-x)/50}{x/25}$ (1) $0.2x/25 = (1.5-x)/50$ or $0.4x = 1.5-x$ $x = 1.5/1.4 = 1.07$g (1) Second extraction – remaining product = 0.43g $0.2 = \frac{(0.43-x)/50}{x/25}$ or $0.2x/25 = (0.43-x)/50$ $0.4x = 0.43-x$ hence $1.4x = 0.43$ or $x = 0.307$ Total mass extracted = 1.07 + 0.307 = 1.38g (1)	**4** **Total : 12**

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Question	Expected Answers	Marks
4	**(a) (i)** Raoult's law	1
	(ii) Liquids in which the intermolecular forces are the same/similar in each (allow examples)	1
	(iii) Mixtures in which the forces between particles in the mixture are weaker than those in either pure liquid	1
	(b) (i) A mixture with a constant boiling point / mixture distilling with const. composition (1)	1
	(ii) Column contains inert packing material (1) Efficiency of the column depends on large surface area of packing (1) At any point there is an equilibrium between liquid and vapour phases (1) Equilibria are established between slightly different mixtures throughout the column (1) Theoretical plates are the stages needed to produce a distillate of given composition (1) They can be determined using a boiling point – composition curve (1) Horizontal and vertical lines are drawn from the liquid line at the starting composition until they reach the vapour line of the desired composition (1) The number of vaporisations is the number of theoretical plates (1)	**6 max**
	Mark fully labelled diagrams as equivalent	1
	QoWC : Correct use of terms such as distribution between phases, theoretical plates etc.	**Total : 11**