

2025 4E5N Science Chemistry Prelim Paper Answers

Paper 1

1	2	3	4	5	6	7	8	9	10
B	C	A	B	D	C	A	D	C	B
11	12	13	14	15	16	17	18	19	20
D	B	A	C	B	C	C	D	C	A

Paper 3

1	(a)	ZnCl ₂	[1] each
	(b)	Al ₂ O ₃	
	(c)	CuCO ₃	
	(d)	(NH ₄) ₂ SO ₄	

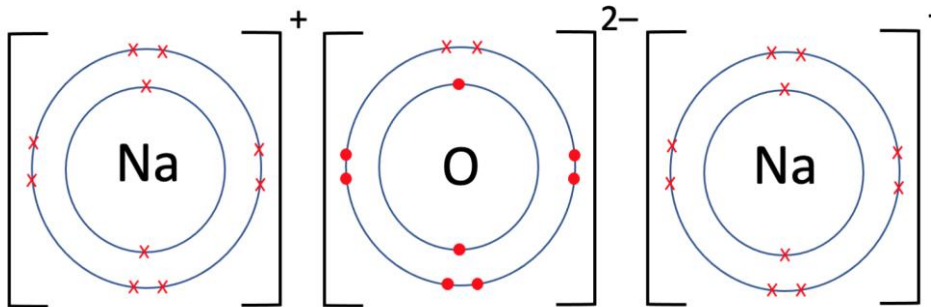
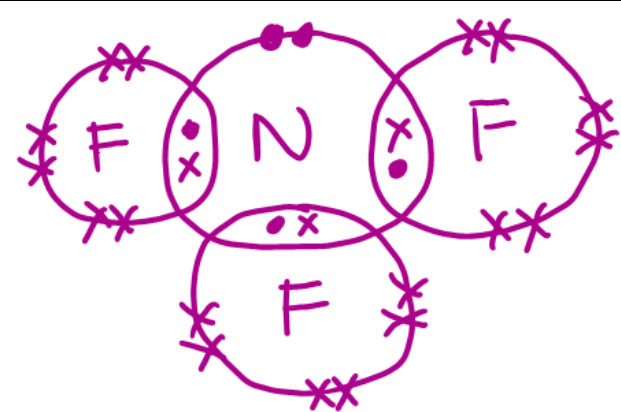
2	(a)	To provide cooling surface for cooling and condensing the vapour of liquid back into distillation flask.	[1]
	(b)	hexane	[1]
	(c)	Arrangement: Changes from closely packed in a disorderly arrangement to far apart in random arrangement	[1]
		Movement: Changes from rolling and sliding past one another to moving randomly at high speeds	[1]

3	(a)	Na ⁺ , Mg ²⁺ , Al ³⁺ : 2,8 P ³⁻ , S ²⁻ , Cl ⁻ : 2,8,8 Every 3 correct: [1]	[2]
	(b)	(i) Atomic radii of non-metal atoms are smaller than metal atoms.	[1]
		(ii) Ionic radii of metal ions are smaller than non-metal ions.	[1]
		(iii) Metal ions have less electron shells than non-metal ions.	[1]
	(c)	Argon has a fully-filled valence shell of electrons / stable octet structure so it does not need to lose or gain electrons to form ion.	[1]

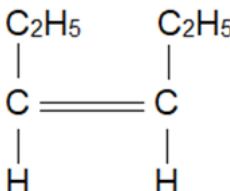
4	(a)	R : iron(II) sulfate / FeSO_4 S : iron(II) carbonate / FeCO_3 T : iron(II) hydroxide / Fe(OH)_2 U : barium sulfate / BaSO_4	[4]
	(b)	$\text{Fe}^{2+}(\text{aq}) + \text{CO}_3^{2-}(\text{aq}) \rightarrow \text{FeCO}_3(\text{s})$ 1 mark for correct equation 0.5 mark for correctly balanced 0.5 mark for correct state symbols	[2]
	(c)	Purple acidified potassium manganate(VII) turns colourless .	[1]

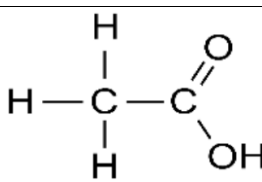
5	(a)	(i)	<table><tr><td>element</td><td>oxidation state before reaction</td><td>oxidation state after reaction</td></tr><tr><td>aluminium</td><td>0</td><td>+3</td></tr><tr><td>iron</td><td>+3</td><td>0</td></tr></table>	element	oxidation state before reaction	oxidation state after reaction	aluminium	0	+3	iron	+3	0	[1] for every 2 correct
element	oxidation state before reaction	oxidation state after reaction											
aluminium	0	+3											
iron	+3	0											
		(ii)	Al is oxidised when the oxidation state of Al increases from 0 in Al to +3 in Al ₂ O ₃ . [1] Fe₂O₃ is reduced when the oxidation state of Fe decreases from +3 in Fe ₂ O ₃ to 0 in Fe. [1]	[2]									
	(b)	Exothermic [1] A lot of heat is released.[1]		[2]									
	(c)	No. of moles of Fe = 1000/6 = 17.857 Mole ratio Fe : Al 1 : 1 Mass of Al 17.857 x 27 = 482 g (3sf)		[1] [1]									

6	(a)		Melting and boiling point increase down the group. / Colour intensity increases down the group. / Density increases down the group.	[1]
	(b)	(i)	Iodine gas/ I_2	[1]
		(ii)	Fluorine is more reactive than iodine so fluorine displaces iodine from potassium iodide , producing potassium fluoride and iodine gas.	[1]

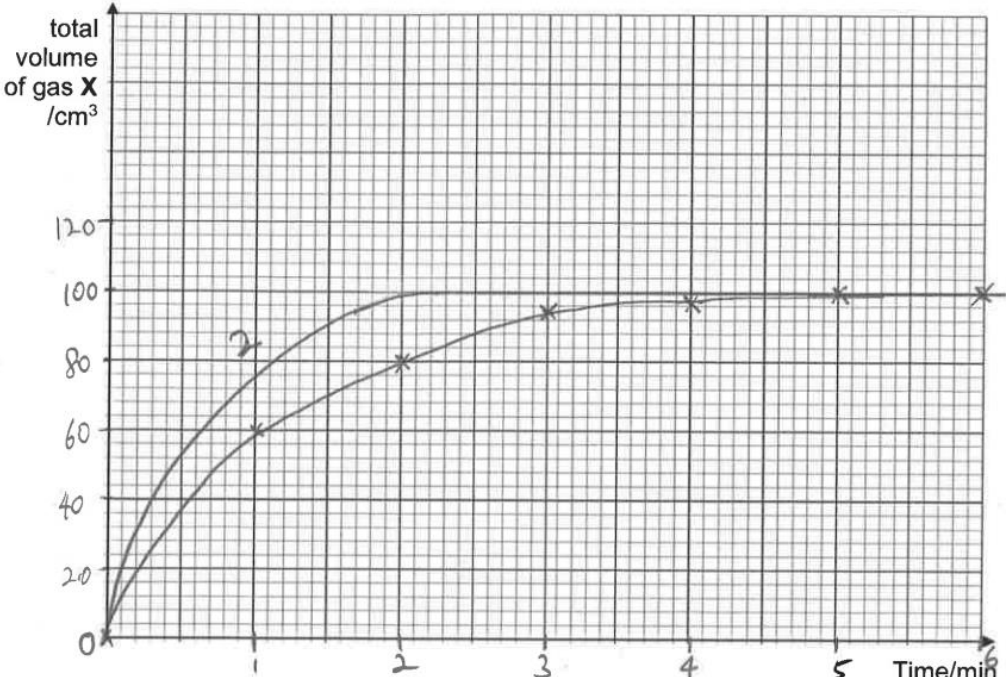
7	(a)	(i)	 1m for cation and 1m for anion. [if only valence electrons shown, 1 mark]	[2]
		(ii)	One oxygen atom gains 2 electrons from two sodium atoms [0.5] in order to achieve a fully-filled valence shell/ stable electronic configuration of noble gas. [0.5] Two sodium atom each lose 1 electron to one oxygen atom in order to achieve a fully-filled valence shell/ stable electronic configuration of noble gas. [0.5]	[1]
	(b)	(i)	 [1 mark for correct number of bonding electrons ; 1 mark for correct number of non-bonding electrons]	[2]
		(ii)	NF₃ has a <u>low boiling point</u> as it has <u>a simple molecular structure</u> [1]. <u>Small amount of energy</u> is needed to overcome the <u>weak intermolecular forces</u> between molecules [1] during boiling, hence it is a gas at room temperature.	[2]
		(iii)	Increased levels of greenhouse gases trap heat, leading to global warming and climate change causing: • Decrease in crop yield due to droughts • Melting of ice caps leading to flooding which destroys habitats • Increase in heat-related illnesses due to higher temperatures	[1]

			Death and destruction of property due to increase in frequency and intensity of typhoons / tornadoes [Accept any answers – 1 mark]	
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8	(a)		$C_6H_{12} + 9O_2 \rightarrow 6CO_2 + 6H_2O$ [0.5] for correct formula [0.5] for correct balancing	[1]
	(b)	(i)	Substitution	[1]
		(ii)	$C_6H_{11}Cl$	[1]
	(c)	(i)		[1]
		(ii)	$C_6H_{12}Br_2$	[1]

9	(a)	(i)	$C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$	[1]
		(ii)	The enzyme in yeast will be killed (denatured) by heat and fermentation will stop.	[1]
		(iii)	fractional distillation	[1]
		(iv)		[1]
	(b)	(i)	burette	[1]
		(ii)	measuring cylinder	[1]
		(iii)	gas syringe	[1]
	(c)		The alcohols can be represented by the same general formula , $C_nH_{2n+1}OH$. / Successive alcohols will differ by a CH_2 unit. / Physical properties of alcohols show a gradual change as the molecular mass increases [Exhibit similar chemical reaction – Rejected]	[2]

10	(a)	$Mg + H_2SO_4 \rightarrow MgSO_4 + H_2$	[1]
	(b)	Place a lighted splint near the mouth of test tube. [1] Hydrogen gas extinguishes with a 'pop' sound. [1]	[2]

(c)	(i) (iv)	 [1] for all points plotted correctly; [1] smooth curve drawn For (c)(iv), [1] steeper gradient; same height	[2] [1]
	(ii)	The limiting reactant has been completely/fully reacted.	[1]
	(iii)	Time taken for zinc is longer as zinc is less reactive than magnesium so slower rate of reaction.	[1]
	(v)	In experiment 2, the reacting particles gain more kinetic energy. They move faster and collide more. [0.5] There is a higher proportion of reacting particles having sufficient (minimum) energy to overcome activation energy barrier. [0.5] The frequency of effective collisions between reacting particles increases[0.5], thus speed of reaction increases. [0.5]	[2]

11	(a)	(i)	potassium : Electrolysis of molten ore iron: Reduction using carbon/ carbon monoxide	[1] [1]
		(ii)	silver/gold/platinum	[1]
	(b)	(i)	The rate of uptake of potassium ions increases as the soil pH increase from 2 to 7 and remains constant after pH 7.	[1]
		(ii)	Excess calcium hydroxide increases the pH of the soil above 7 [1] but the rate of uptake of potassium ions does not increase after pH 7.[1]	[2]
	(c)	Add the same mass of ore A and B in the same volume and concentration of nitric acid, separately in each conical flask. [1] Measure the volume of carbon dioxide gas collected [1] until the volume of gas collected remains constant . [1] The metal ore that produces a greater volume of carbon dioxide gas contains more copper(II) carbonate. [1]		[4]