

Prelim Exam 2018
4E/5N Sc(Chem)
Marking Scheme

Section A [1 mark each; 20 marks total]

1	2	3	4	5	6	7	8	9	10
B	D	C	D	B	A	B	A	B	D

11	12	13	14	15	16	17	18	19	20
D	A	B	D	C	D	B	B	D	A

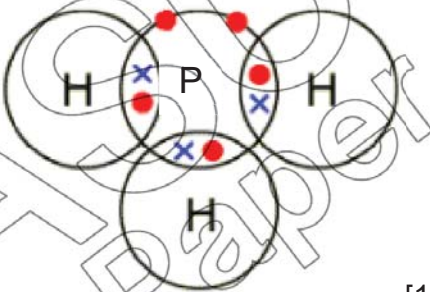
Section B [45 marks total]

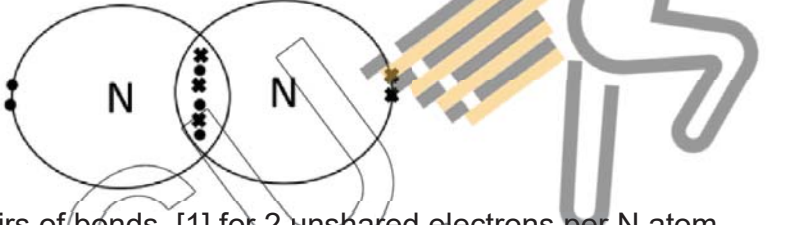
1	(a)	C	[1]
	(b)	B	[1]
	(c)	B [1] It has only one type of atom. [1]	[2]
	(d)	A	[1]
2	(a)	(i) It has the same number of protons and electrons; 15 each.	[1]
		(ii) All have the same number of protons (15) / same proton number / same atomic number	[1]
		(iii) same number of protons (15) / same proton number / same atomic number [1]; Different number of neutrons / different nucleon number / different mass number [1]	[2]
	(b)	(i) 2.8.5 / 2,8,5 [1] (ii) non-metal because it accepts electrons / needs 3 electrons to complete valence electron shell / because it is in Group V or 5 electrons in valence shell [1] Note: need both non-metal and reason for one mark	[2]

5	(a)	magnesium → X → iron → lead / $Mg > X > Fe > Pb$	[1]
	(b)	no / it will not react and zinc is more reactive / iron is less reactive; [1] ignore: zinc is reactive / iron is unreactive	[1]
	(c)	A greenish ppt/solid [1] and a grey/silver solid are formed. [1]	[2]
	(d)	Iron is reduced.[1] The oxidation state of iron decreases from +3 in iron(III) oxide to 0 in iron. [1]	[2]
6	(a)	(i) Nitrate [1] All nitrates are soluble. [1] or Sulfate [1] All Ag^+ , Cu^{2+} , Zn^{2+} and Fe^{3+} sulfates are soluble. [1]	[2]
		(ii) Add sodium hydroxide, aluminium foil and warm. [0.5] Gas produced turns moist red litmus paper blue. [0.5] or Add barium nitrate / barium chloride. [0.5] A white precipitate is seen. [0.5]	[1]
	(b)	B: silver chloride / $AgCl$ [1] C: copper(II) hydroxide / $Cu(OH)_2$ / iron(II) hydroxide / $Fe(OH)_2$ [1]	[2]
	(c)	The particles are in solid state. They vibrate at their fixed positions. [1] They are closely packed in a orderly manner. [1]	[2]
7	(a)	(i) Contains only carbon-carbon single bonds	[1]
		(ii) Contains only carbon and hydrogen atoms	[1]
	(b)	$C_6H_{12} + 9O_2 \rightarrow 6CO_2 + 6H_2O$	[1]
	(c)	HCl (1) $C_6H_{11}Cl$ (1)	[2]

Section C (20 marks)

<p>8</p>	<p>(a)</p>	<p>(i) zinc displaces copper / zinc more reactive than copper; [1] $\text{Zn} + \text{CuCl}_2 \rightarrow \text{ZnCl}_2 + \text{Cu}$ / $\text{Zn} + \text{Cu}^{2+} \rightarrow \text{Cu} + \text{Zn}^{2+}$; [1]</p> <p>(ii) less steep (line) or lower gradient / (because of) decreased rate; [1] ethanoic is a weak(er) acid / only partially ionised / dissociated / lower concentration of hydrogen ions; [1]; graph 3 is below graph 1 and ends at the same volume as graph 1 [1]</p>	<p>[5]</p>
	<p>(b)</p>	<p>3 marks from any 3 differences in observations e.g.</p> <ul style="list-style-type: none"> • more bubbles with K; • it /K moves faster (on water surface); • Li does not catch fire/K catches fire/K bursts into flame; • it /K fizzes more than Li; • it /K disappears rapidly; • K explodes / lithium does not explode; • K melts / ball with K/lithium does not melt/ does not go into ball [3] <p>Products: lithium hydroxide [0.5] potassium hydroxide; [0.5] hydrogen/H₂ [1]</p>	<p>[5]</p>

9	(a)	<p>(i) Phosphine is a liquid / gas at room condition [1] It is made up of 2 non-metals [1] which will form a covalent compound which is a liquid / gas at room conditions. [1] /</p> <p>Phosphine has low melting and boiling points [1] It is a simple covalent molecule [1] with weak intermolecular forces of attraction. Hence little energy is needed to overcome them. [1] /</p> <p>Phosphine does not conduct electricity in any state [1] It has no mobile ions [1] or mobile electrons to carry the current to conduct electricity. [1]</p> <p>Any 2 points with explanations maximum [5]</p>	[5]
	(ii)	 <p>[1] for P, [1] for H</p>	[2]
	(b)	<p>react with hydrogen or hydrogenation [1] in the presence of a nickel catalyst at 60 °C (allow 50-200 °C) [1] because vegetable oils are unsaturated or have carbon-carbon double bonds (vegetable oils are hardened) to make them solid at room temperature or to make them useful as spreads/spreadable [1]</p>	[3]

10	(a)	(i) 2, 2, 3 [1] (s), (s), (g) [1]	[2]
	(ii)	 <p>[1] for 3 pairs of bonds, [1] for 2 unshared electrons per N atom</p>	[2]
	(iii)	<p>Mole of $\text{NaN}_3 = \text{mass} / \text{molar mass}$ $= 130 / (23 + (14 \times 3)) = 2$ [1]</p> <p>Mole ratio $\text{NaN}_3 : \text{N}_2$ From eqn 2 : 3 From data 2 : 3 [0.5]</p> <p>Vol of $\text{N}_2 = \text{mol} \times 24$ $= 3 \times 24 = 72 \text{ dm}^3$ [1]</p> <p>It was not efficient as only 60 dm^3 of N_2 was produced. [0.5]</p>	[3]
	(b)	<p>Cracking [1]</p> <p>Big alkane \rightarrow smaller alkanes + smaller alkene (+ hydrogen) $\text{C}_{20}\text{H}_{42} \rightarrow \text{C}_{12}\text{H}_{26} + \text{C}_8\text{H}_{16}$ (any appropriate balanced equation) [1]</p> <p>It undergoes cracking to produce small(er) molecules / alkanes hydrocarbons and alkenes or a named alkene [1]</p>	[3]

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Section B [45 marks total]

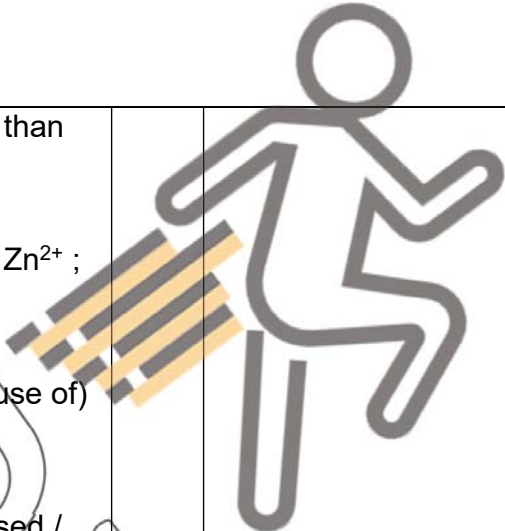
				Marker's Comments
1	(a)	C	[1]	
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	(d)	A	[1]	
2	(a)	(i) It has the same number of protons and electrons; 15 each.	[1]	
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	(b)	(i) 2,8,5 / 2,8,5 [1] (ii) non-metal because it accepts electrons / needs 3 electrons to complete valence electron shell / because it is in Group V or 5 electrons in valence shell [1] Note: need both non-metal and reason for one mark	[2]	

3	(a)	NO will be oxidised by oxygen in air to form nitrogen dioxide. [1] Nitrogen dioxide will then dissolve in rainwater to form nitric acid which caused acid rain. [1]	[2]
	(b)	Calcium carbonate is very much less soluble than calcium hydroxide and calcium oxide. [1] Thus, CaCO ₃ reacts slowly with acid / effective only in reducing acidity of soil / surface in contact / cannot penetrate soil to neutralize acid deeper down. [1]	[2]
	(c)	The high temperatures of the car engines causes [1] nitrogen in the air to react with oxygen in the air producing oxides of nitrogen. [1]	[2]
	(d)	<ul style="list-style-type: none"> ➤ irritates the eyes and lungs and cause breathing difficulties [1] ➤ high levels lead to inflammation of the lungs (bronchitis) [1] 	[2]
4	(a)	<p>Step 2 Filter to remove excess cobalt(II) carbonate; [1]</p> <p>Step 3 Heat the filtrate till saturation; [1]</p> <p>Step 4 Cool to allow crystals to form; [0.5]</p> <p>Step 5 Rinse crystals with a little distilled water to remove impurities and dry between sheets of filter paper; [0.5]</p>	[3]

	<p>(b)</p> <p>(i) $\text{CoCO}_3(\text{s}) + 2\text{HCl}(\text{aq}) \rightarrow \text{CoCl}_2(\text{aq}) + \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$ State symbols [1]; balanced chemical equation [1]</p>	[2]	
	<p>(ii) no of moles of HCl = $cv = 2 * (40/1000) = 0.08$ mol [1]</p> <p>Mole ratio $\text{CoCO}_3 : \text{HCl}$ From eqn 1 : 2 From data 0.04 : 0.08 [1]</p> <p>Mass of $\text{CoCO}_3 = \text{mol} * \text{molar mass} = 0.04 * (59+12+48) = 0.04 * 119 = 4.76$ g [1]</p> <p>4.76 g of CoCO_3 needed but 5.95 g was used. Hence, CoCO_3 was in excess.</p>	[3]	
5	<p>(a) magnesium \rightarrow X \rightarrow iron \rightarrow lead / $\text{Mg} > \text{X} > \text{Fe} > \text{Pb}$</p>	[1]	
	<p>(b) no / it will not react and Zinc is more reactive / iron is less reactive; [1] ignore: zinc is reactive / iron is unreactive</p>	[1]	
	<p>(c) A greenish ppt/solid [1] and a grey/silver solid are formed. [1]</p>	[2]	
	<p>(d) Iron is reduced.[1] The oxidation state of iron decreases from +3 in iron(III) oxide to 0 in iron. [1]</p>	[2]	

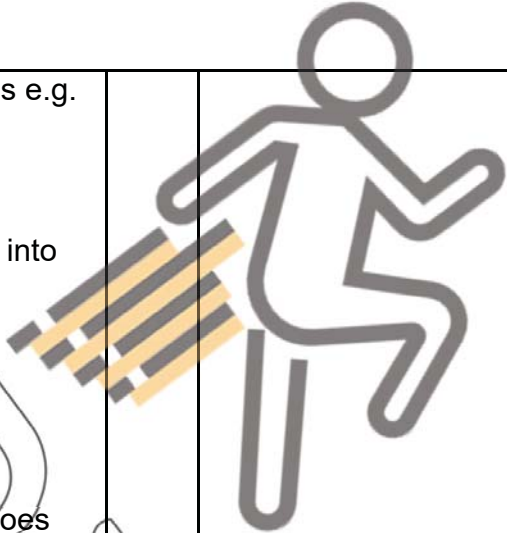
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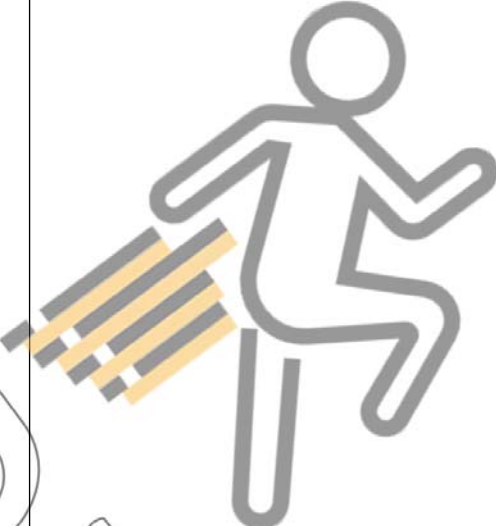
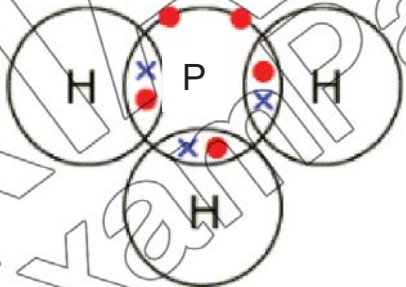
Section C (20 marks)

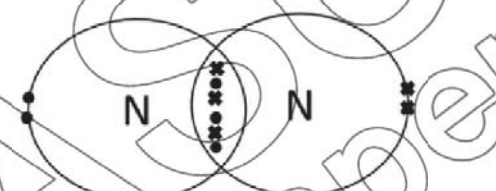
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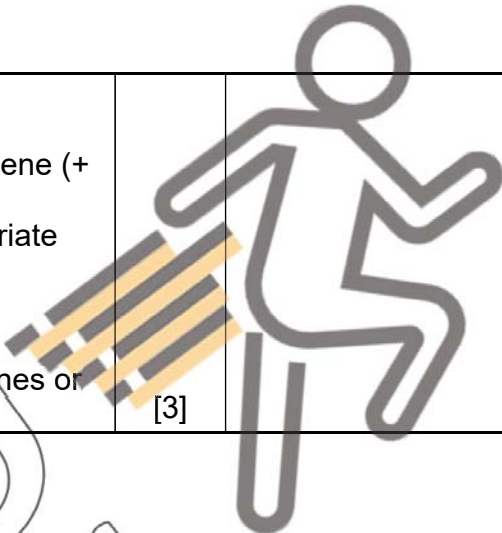
252

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	<p>(b) 3 marks from any 3 differences in observations e.g.</p> <ul style="list-style-type: none"> • more bubbles with K; • it /K moves faster (on water surface); • Li does not catch fire/K catches fire/K bursts into flame; • it /K fizzes more than Li; • it /K disappears rapidly; • K explodes / lithium does not explode; • K melts / ball with K/ lithium does not melt/ does not go into ball. [3] <p>Products: lithium hydroxide [0.5] potassium hydroxide; [0.5] hydrogen/H₂ [1]</p>	[5]	
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