OCR GCSE GATEWAY CHEMISTRY A · J248

CHEMISTRY



MARK SCHEME

WS1.4 SCIENTIFIC VOCABULARY, QUANTITIES, UNITS, SYMBOLS AND NOMENCLATURE

SCORE	PERCENTAGE
/79	%

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Question			Answer/Indicative content	Marks	Guidance
1			add water (1) **but** 1 part sugar solution and 3 parts water (2)	2	 **allow** specific quantities e.g. 10 cm^3 of sugar solution added to 30 cm^3 of water (2)
			Total	**2**	
2			28.6 (%) (2) **but if answer incorrect then** $\frac{12 \times 100}{42}$ (1)	**2**	**allow** 28.5 (1)
			Total	**2**	
3			NaOH + HC*l* → NaC*l* + H_2O ✓	1 (AO 2.2)	**ALLOW** = or ⇌ instead of → **DO NOT ALLOW** and or & instead of + **ALLOW** any correct multiples including fractions **IGNORE** any state symbols Examiner's Comments Higher ability candidates gave a correct equation. Common incorrect responses included: no H_2O; H_2 instead of H_2O; $NaCl_2$; $Na(OH)_2$; Na_2OH; or just giving one side of the equation.
			Total	**1**	
4			A	1 (AO1.1)	
			Total	**1**	
5			B	1 (AO2.1)	
			Total	**1**	
6			A	1 (AO2.1)	
			Total	**1**	

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Question			Answer/Indicative content	Marks	Guidance
7			A	1 (AO1.1)	
			Total	**1**	
8			B	1 (AO2.1)	
			Total	**1**	
9			B	1 (AO2.1)	
			Total	**1**	
10		i	Condenser ✓	1 (AO1.2)	
		ii	Distillation ✓	1 (AO1.1)	**DO NOT ALLOW** fractional
		iii	Add thermometer ✓ Water goes in at the bottom (of condenser) **OR** water comes out at the top (of condenser) ✓	2 (AO2 × 3.3b)	**ALLOW** take out the funnel
			Total	**4**	
11			C ✓	1 (AO1.1)	
			Total	**1**	
12			D ✓	1 (AO2.2)	
			Total	**1**	
13			A ✓	1 (AO2.1)	
			Total	**1**	
14			B ✓	1 (AO2.1)	
			Total	**1**	

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Question			Answer/Indicative content	Marks	Guidance
15	a	i	$Zn + 2HCl \rightarrow ZnCl_2 + H_2$ Reactants ✓ Balancing ✓	2 (AO2.2)	**ALLOW** any correct multiple, including fractions **ALLOW** = **OR** ⇌ instead of → **DO NOT ALLOW** and / & instead of '+' balancing mark is dependent on the correct formulae but **ALLOW** 1 mark for a balanced equation with a minor error in subscripts / formulae eg $Zn + 2HCL \rightarrow ZNCl_2 + H_2$
		ii	Exothermic ✓	1 (AO1.1)	
	b		Energy required to start the reaction / energy required for a successful collision to occur / AW ✓	1 (AO1.1)	**IGNORE** energy needed to activate the reaction / amount of energy for the reaction to take place
	c	i	Bond breaking is endothermic / takes in energy ✓ Bond making is exothermic / gives out energy ✓ More energy is given out (during bond making) than is taken in (during bond breaking) ✓	3 (AO2 × 1.1) (AO2.1)	**DO NOT ALLOW** ideas about more bonds **IGNORE** idea that more energy is **used** during bond making than is taken in during bond breaking **IGNORE** idea that it takes more energy to make bonds than to break bonds
		ii	C–H: 4 × 413 = 1652 **AND** O=O: 2 × 498 = 996 Total energy = 1652 + 996 = 2648 (kJ / mol) ✓	1 (AO1.2)	
		iii	C=O: 2 × 805 = 1610 **AND** O–H: 4 × 464 = 1856 Total energy = 1610 + 1856 = 3466 (kJ / mol) ✓	1 (AO1.2)	
		iv	Energy change = 2648 – 3466 = –818 (kJ / mol) ✓	1 (AO1.2)	Answer MUST show – sign for mark **ALLOW** ECF from parts (ii) & (iii)
			Total	**10**	

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Question			Answer/Indicative content	Marks	Guidance
16	a	i	FIRST CHECK ANSWER ON ANSWER LINE If answer = 0.62 award 3 marks R_f = distance travelled by substance / distance travelled by solvent = 37/60 ✓ = 0.61666…. ✓ = 0.62 (2 significant figures) ✓	3 (AO1.1) (AO2.2) (AO1.2)	**ALLOW** ECF for use of correct calculation from incorrect measurements **ALLOW** 0.59 – 0.67 **ALLOW** ECF for sig fig mark
		ii	A and B	1 (AO3.2a)	Both needed for the mark
		iii	Idea that D forms weak(er) bonds with the mobile phase than C / Idea that D forms strong(er) bonds with stationary phase than C / D is less polar than C / ORA ✓	1 (AO2.1)	**ALLOW** C is more soluble (in the solvent) than D / ORA
	b	i	Similarity: Both have stationary and mobile phases / both use silica in the stationary phase ✓ Difference: Thin-layer uses liquid for mobile phase / gas chromatography use gas for mobile phase ✓	2 (AO2 × 1.1)	**ALLOW** the mobile phases are different states
		ii	Thin-layer chromatography is used to separate solids / gas chromatography is used to separate gases (in a gas mixture) ✓	1 (AO2.1)	**ALLOW** idea that the tomato sauce is a liquid or not a gas
			Total	8	

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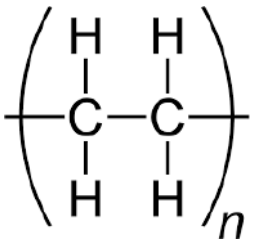
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Question			Answer/Indicative content	Marks	Guidance
17		i	Na_2O (s) + H_2O (l) → 2NaOH (aq) Formulae ✓ Balancing ✓ State symbols ✓	3 (AO2.1) (AO1.2) (AO2.1)	**ALLOW** any correct multiple, including fractions **ALLOW** = **OR** ⇌ instead of → **DO NOT ALLOW** and / & instead of '+' balancing mark is dependent on the correct formulae but **ALLOW** 1 mark for a balanced equation with a minor error in subscripts / formulae e.g. NAO + H_2O →2NaOH State symbols mark is independent of formulae & balancing marks
		ii	Hydroxide / OH^- ions ☐	1 (AO1.1)	
		iii	Sodium sulfate✓	1 (AO2.1)	**ALLOW** Na_2SO_4 **IGNORE** incorrect formulae if correct name is given
		iv	**FIRST CHECK ANSWER ON ANSWER LINE** **If answer = 100 award 2 marks** pH increased by 2 concentration decreases by a factor of 10 × 10 ✓ 100 ✓	2 (AO2.2)	**ALLOW** for 1 mark pH increase by 1, so concentration decreased by a factor of 10
			Total	**7**	
18			**D** ✓	1 (AO1.1)	
			Total	**1**	
19			**C** ✓	1 (AO1.1)	
			Total	**1**	
20			**B** ✓	1 (AO2.1)	
			Total	**1**	

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Question			Answer/Indicative content	Marks	Guidance
21			B ✓	1 (AO2.1)	
			Total	**1**	
22	a		**Any two from:** Have the same general formula / both have the formula C_nH_{2n+2} ✓ Idea that they differ from each other by CH_2 ✓ They are both saturated / idea that their carbon atoms are joined to each other by (only) single (covalent) bonds ✓	2 (AO1.1)	**ALLOW** have similar chemical properties **ALLOW** show trends in physical properties
	b	i	(Ethene) molecules have a (carbon to carbon) double bond / (Ethane) molecules do not have a (carbon to carbon) double bond or only have single bonds ✓	1 (AO2.2)	
		ii	 Single bond between the carbon atoms ✓ Single bonds to the side of each carbon atom ✓	2 (AO2.1)	
			Total	**5**	
23			A ✓	1 (AO1.1)	
			Total	**1**	
24			D ✓	1 (AO2.1)	
			Total	**1**	
25			B ✓	1 (AO1.1)	
			Total	**1**	

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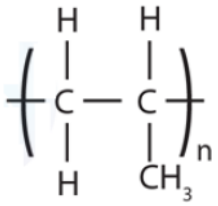
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Question			Answer/Indicative content	Marks	Guidance
26			D ✓	1 (AO1.1)	
			Total	1	
27			C ✓	1 (AO2.2)	
			Total	1	
28			(Sodium atom) loses an electron / Oxidation is loss of electrons ✓	1 (AO1.1)	
			Total	1	

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Question			Answer/Indicative content	Marks	Guidance
29	a	i	**A** and **D** ✓	1 (AO2.1)	**Both required for the mark**
		ii	**Any two from:** Have the same general formula / both have the formula C_nH_{2n+2} ✓ Idea that they differ from each other by CH_2 ✓ Both hydrocarbons with only single bonds / both saturated hydrocarbons ✓	2 (AO1.1)	**ALLOW** have similar chemical properties **ALLOW** show trends in physical properties **ALLOW** both hydrocarbons with no double bonds **ALLOW A** and **D** have the same functional group or no functional group / **B** and **C** have different functional groups (from **A** and **D**) **ALLOW** both (**A** and **D**) are alkanes / **C** is an alkene and **B** is a carboxylic acid
	b	i	 Correct structure ✓ Brackets and 'n' ✓	2 (AO2.1)	**ALLOW** structure of $-CH_3$ group shown **ALLOW** round or square brackets **Second marking point is dependent on correct structure**

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Question			Answer/Indicative content	Marks	Guidance
		ii	**Any one from:** Idea that in addition polymerisation monomers react together to form one large molecule / polymer whereas in condensation polymerisation one large molecule and a smaller molecule is formed ✓ A monomer (molecule) for addition polymerisation has one functional group whereas a monomer (molecule) for condensation polymerisation requires two different functional groups ✓ Addition polymerisation requires a catalyst (whereas condensation polymerisation can happen without a catalyst) / ORA ✓ Addition polymerisation requires high temperature (whereas condensation polymerisation can happen at room temperature) / ORA ✓ Addition polymerisation requires high pressure (whereas condensation polymerisation can happen at atmospheric pressure) / ORA ✓	1 (AO1.1)	**ALLOW** condensation polymerisation produces water (whereas addition polymerisation does not) **ALLOW** idea that addition polymerisation makes one product (whereas condensation polymerisation makes two products) / ORA **ALLOW** addition polymerisation requires (a monomer) with a C=C, but condensation polymerisation requires a -NH2 group and a-COOH group
			Total	5	

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Question			Answer/Indicative content	Marks	Guidance
30	a		**Any one from:** Use a single indicator / named single indicator eg methyl orange / phenolphthalein (instead of universal indicator)✓ Idea that universal indicator does not give a sudden colour change / universal indicator gives a continuous colour change / ORA ✓ **OR** Fill the burette exactly to the 0.00 cm^3 line ✓ Idea that this will give accurate volume of acid ✓ **OR** Idea of adding acid to the alkali <u>slowly</u> **or** <u>dropwise</u> (near the end point) ✓ Idea that indicator should change colour on addition of one drop (of acid) ✓ **OR** Idea of swirling the alkali while adding the acid ✓ To ensure mixing of acid and alkali / AW ✓ **OR** Use a white tile under the conical flask ✓ To see the colour change easily / clearly ✓ **OR** Repeat the experiment <u>until concordant or consistent results are obtained</u> ✓ To obtain a more accurate titre / AW ✓ **OR** Idea of doing a rough titration ✓ As this will give you an idea of the endpoint ✓	2 (AO3.3b)	**Explanation must be linked to improvement** **ALLOW** idea of using a pH probe or pH meter to give a more accurate indication of when neutralisation occurs **ALLOW** idea of missing the end point **ALLOW** two improvements, with no explanation, for 1 mark if no explanations given

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Question			Answer/Indicative content	Marks	Guidance
	b	i	FIRST CHECK THE ANSWER ON ANSWER LINE **If answer = 23.65 (cm^3) award 2 marks** Use of volume of acid from titrations 2, 3 & 4 / Use of 23.60, 23.70 & 23.65 ✓ Accurate volume of acid = 23.65 (cm^3) ✓	2 (AO2.2)	**DO NOT ALLOW** 23.7 (cm^3) **ALLOW** 1 mark for average calculated using all results, ie 24.18 / 24.175 (cm^3) but **DO NOT ALLOW** 24.2 (cm^3)
		ii	FIRST CHECK THE ANSWER ON ANSWER LINE **If answer = 0.106 (mol / dm^3) award 4 marks** moles of alkali $= \frac{0.200 \times 25.0}{1000}$ / 0.200 x 0.0250 / moles of acid = $\frac{0.005}{2}$ = 0.0025 / 2.5×10^{-3} ✓ $= \frac{0.0025}{0.02365}$ / $\frac{0.0025 \times 1000}{23.65}$ / $\frac{2.5 \times 10^{-3}}{0.02365}$ / $\frac{2.5 \times 10^{-3} \times 1000}{23.65}$ / 0.1057 (mol/dm^3) ✓ concentration = 0.106 (mol / dm^3) (3 sig. figs) ✓	4 (AO3 × 2.2) (AO1.2)	**ALLOW** ECF from moles of alkali **ALLOW** ECF from average titre in **(i)** **ALLOW** ECF from moles of acid i.e. conc = $\frac{\text{moles}}{0.02365}$ or $\frac{\text{moles} \times 1000}{23.65}$
			Total	8	

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Question			Answer/Indicative content	Marks	Guidance
31			**Any three from:** Idea that energy transferred by radiation from the Sun warms up the Earth's surface ✓ Idea that infrared radiation is emitted by the Earth's surface ✓ Idea that some infrared radiation goes directly into space ✓ Idea that greenhouse gases absorb (some) infrared radiation (radiated by the Earth's surface) ✓ Idea that greenhouse gas molecules emit infrared radiation (in all directions), warming the Earth's surface / atmosphere ✓	3 (AO1.1)	**DO NOT ALLOW** references to the ozone layer **ALLOW** energy instead of infrared radiation throughout **IGNORE** idea of trapping infrared radiation **ALLOW** named greenhouse gases eg carbon dioxide / methane
			Total	**3**	
32			Cu^{2+}, SO_4^{2-}, H^+, OH^-	2 (AO2.2)	All 4 ions correct for 2 marks 2 or 3 ions correct for 1 mark
			Total	**2**	
33	a		g/dm^3 **and** mol/dm^3 (1)	1	**both required**
	b		cm^3 and dm^3 (1)	1	**both required**
			Total	**2**	

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