CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge Ordinary Level

MARK SCHEME for the October/November 2014 series

5070 CHEMISTRY

5070/21 Paper 2 (Theory), maximum raw mark 75

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A1 (a) (i) C / carbon / Si / silicon (1) [1]

(ii) N / nitrogen (1) [1]

(iii) K / potassium (1) [1]

(iv) N / nitrogen (1) [1]

(v) C / carbon (1) [1]

(vi) Zn / zinc (1) [1]

(b) $4K + O_2 \rightarrow 2K_2O$ (1) [1]

(c) aluminium forms an oxide layer (1)

layer is unreactive / layer cannot be easily removed from the surface / layer adheres to (metal) surface / layer is impermeable to water (1) [2]

[Total: 9]

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A2 (a) (i) values between 1.6 and 2.6 (1)
(actual value = 2.15) [1]

(ii) values between –130 and – 80 (1)
(actual value = –107) [1]

(b) (i) arrangement: is random / irregular (1)

motion: rapid / fast / can move anywhere / random (1) [2]

(ii) any suitable use e.g. in steelmaking / in light bulbs / welding (1) [1]

(c) completely filled outer shells of electrons / not able to gain electrons / not able to lose electrons / not able to share electrons (1) [1]

(d) $\mathbf{3}XeF_4 + \mathbf{6}H_2O \rightarrow Xe + 2XeO_3 + 12HF$ (1) [1]

(e) ANY THREE FROM

air liquefied (1)

temperature of liquefied air raised (gradually) / liquid air is heated (1)

gas with lowest boiling point vaporises first (1)

idea of fractionation depending on difference in boiling points (1)

idea of fractionation depending differences in size (or mass) of the atoms or molecules (1) [3]

[Total: 10]

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A3 (a) chromatography paper dipping into labelled solvent in a beaker (1)

solvent level below the spots at start of experiment / below base line drawn / below marked spot (1) [2]

(b) (i) **B** and **E** (1) [1]

(ii) 0.68 to 0.72 (1) [1]

(c) (i) to make the spots visible / because the spots may not be coloured (1) [1]

(ii) (light) blue precipitate (1)

(dark) blue solution in excess (1) [2]

(iii) $Cu^{2+}(aq) + 2OH^{-}(aq) \rightarrow Cu(OH)_2(s)$

correct formulae (1)

correct state symbols (dependent on correct formulae) (1) [2]

[Total: 9]

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A4 (a) (i) $Zn \rightarrow Zn^{2+} + 2e^{-}$ / $Zn - 2e^{-} \rightarrow Zn^{2+}$ (1) [1]

(ii) in the copper / silver cell the copper is the negative electrode (1) [1]

(iii) silver and magnesium (1) [1]

(iv) magnesium
zinc
iron
tin
copper (1)

the higher the voltage (difference between copper and the metal) the more reactive the metal / voltage (difference) gets smaller, the less reactive the metal (1) [2]

(b) (i) metal layers (1)

slide over each other when force applied (1) [2]

(ii) electrons (originating from valency shell) can move / sea of electrons / some of the electrons are mobile / there are free electrons (1) [1]

(c) tin prevents oxygen and/or water from reaching the iron (1) [1]

[Total: 9]

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A5 (a) (i) moles acid = 1.2×10^{-3} / 0.0012 mol (1) [1]

(ii) moles OH^- ions = 2.4×10^{-3} / 0.0024 mol (1) [1]

(iii) sulfuric (acid) (no mark but if incorrect 0, marks for question)

mole ratio of acid to OH^- is 1:2 so the acid must have $2H^+$ per mole / only way to get 1:1 ratio of H^+ to OH^- from 1:2 ratio of acid to OH^- (1) [1]

(b) (i) $CaCO_3 + 2HCl \rightarrow CaCl_2 + CO_2 + H_2O$ (1) [1]

(ii) $24 / (2 \times 60) = 0.2\,cm^3/s$ (1) [1]

(iii) ethanoic acid dissociates only slightly / ethanoic acid partially dissociated / hydrochloric acid dissociated fully (1)

lower concentration of H^+ ions in ethanoic acid **OR** reverse argument (1)

lower frequency of collisions (with $CaCO_3$) in ethanoic acid **OR** reverse argument (1) [3]

[Total: 8]

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B6 (a) (i) silicon dioxide is giant covalent structure / has a continuous structure of covalent bonds all linked in 3-dimensions (1)

all bonds are strong / all bonds need high temperature to break / all bonds need a lot of energy to break (1)

poly(ethene) has weak forces between the molecules / weak intermolecular forces (1)

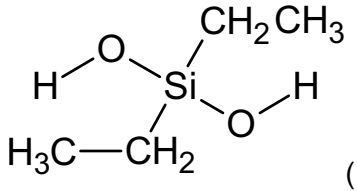
not much energy required to overcome weak forces / weak forces easily broken / small amount of energy required to separate molecules (1) [4]

(b) addition (polymerisation) (1) [1]

(c) hydrocarbon because contains carbon and hydrogen only / contains carbon and hydrogen and no other element (1)

unsaturated because it has a (C=C) double bond (1) [2]

(d)



(1) [1]

(e)

C	H	Si	C*l*	
1.55	4.65	0.775	1.55	(1)
$C_2H_6SiCl_2$				(1)

[2]

[Total: 10]

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B7 (a) $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$ (1) [1]

(b) (i) respiration releases CO_2 **AND** photosynthesis absorbs CO_2 (1)
The (rate of) CO_2 released into the atmosphere is (roughly) the same as the amount absorbed from the atmosphere (1) [2]

(ii) gas which absorbs infra-red radiation / gas which absorbs energy / gas which absorbs heat (1) [1]

(iii) waste gas from animals / rice paddy fields / bacterial action / landfill sites etc. (1) [1]

(iv) ($0.0014\,dm^3$ in $1000\,dm^3$)
and $0.0014 / 24 = 5.833 \times 10^{-5}$ mol CH_4 (1)
$5.833 \times 10^{-5} \times 16 = 9.33 \times 10^{-4}$ g (1) [2]

(c) (i) the oxygen in O_2 comes from the water / the oxygen in the oxygen molecule comes from the water (1) [1]

(ii) protons = 8 **AND** electrons = 8 (1)

neutrons = 10 (1) [2]

[Total: 10]

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B8 (a) $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$ (1) [1]

(b) (i) position of equilibrium shifts to the right (1)

in direction of smaller number of moles / in direction of smaller volume (1) [2]

(ii) position of equilibrium shifts to the left (1)

(forward) reaction is exothermic / reaction goes in direction of absorption of heat (1) [2]

(iii) increases rate of reaction / lowers activation energy / alternate reaction pathway (1)

less fuel used to heat the reaction / less fuel used for the process / a lower temperature can be used / less electricity used to maintain the temperature / need to use the energy for less time (to get same amount of product) (1) [2]

(c) (i) $2 \times CaSO_4 = 2 \times 136 = 272$ (1)
$(272 / 506) \times 100 = 53.8\%$ (1) [2]

(ii) ANY ONE FROM

money or energy wasted in transporting calcium sulfate which is not required (1)

money or energy wasted in transporting substance which is not a fertiliser (1)

waste of money or energy in spreading a substance which is not a fertiliser (onto the soil) (1)

calcium sulfate does not dissolve and so is left on the soil [1]

[Total:10]

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B9 (a) (i) acidity caused by H^+ ions (1)

H^+ ions consumed in the reaction / H^+ ions used up in the reaction (1) [2]

(ii) orange / reddish-brown (1) [1]

(iii) ions or particles have more energy / move faster (1)

more particles or ions have energy above the activation energy / more energetic collisions / more effective collisions / more successful collisions / more fruitful collisions (1) [2]

(b) $Br_2 + 2I^- \rightarrow I_2 + 2Br^-$ (1) [1]

(c) purple solution goes brown (1)

iodide oxidised to iodine / iodine is brown (1) [2]

(d) aqueous bromine decolourised (1) [1]

(e) correct dot and cross diagram for bromine molecule (1) [1]

[Total: 10]

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