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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2012 question paper

for the guidance of teachers

0620 CHEMISTRY

0620/21 Paper 2 (Core Theory), maximum raw mark 80

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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1 **(a)** A: thermometer; [1]
B: beaker; [1]

(b) **(i)** idea that heat is evenly distributed e.g.
to make sure that temperature (of water) is the same throughout / the heat gets to the (stearic) acid at steady rate / the heart gets to test tube at a constant rate / to make sure the water is at an even temperature (throughout) / so not just hot at the bottom / so that hot parts of the water mix with cold; [1]

(ii) anhydrous / white copper sulfate; [1]
turns blue; [1]
or
anhydrous / blue cobalt chloride;
turns pink / turns red;
allow: second mark if copper sulfate or cobalt chloride given without reference to colour or anhydrous

(c) **(i)** 48(°C); [1]

(ii) 72(°C); [1]

(d) arrangement: close together / touching / irregular / random; [1]

motion: sliding over each other / moving slowly; [1]
allow: irregular / random
allow: move faster than solid but slower than gas

(e) **(i)** the melting point is different / 3rd box down ticked; [1]

(ii) any suitable: e.g.
food / medicines / drugs / named food / medicine / cosmetics / drinking water / water for cooking / water for washing; [1]
allow: relevant places or processes where purity of substances is important e.g. drinking / eating / cooking / surgeries / hospitals / kitchen

[Total: 11]

2 **(a)** **(i)** B; [1]
allow: sulfur / S_8 / S

(ii) a substance containing only one type of atom; [1]
allow: a substance with the same type of atoms / a substance containing the same atoms / a substance that cannot be broken down (by chemical means)

(b) 64 [1]

(c) Na_2S [1]

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(d) D; [1]
ions can move / ions are free; [1]

note: second mark dependent on first mark being correct

(e) oxidation; [1]

[Total: 7]

3 **(a)** pH 3; [1]

(b) dip (litmus) paper in the solution / acid or add litmus solution to the acid / add acid to litmus paper; [1]

note: if another substance added e.g. add a metal or a further process e.g. boil the solution, the first mark is lost but the next two marks can still be obtained.

blue litmus; [1]

turns red / pink; [1]
reject: litmus bleaches

note: if the indicator is incorrect, the second two marks cannot be obtained.

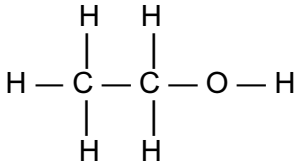
(c) **(i)** calcium carbonate + hydrochloric acid → calcium chloride + carbon dioxide + water [3]
note: –1 per error

(ii) extraction of iron / making cement / making lime / neutralising acidic lakes / (flue gas) desulfurisation / making glass / neutralising acidic waste / any other suitable use; [1]

(iii) calcium oxide; [1]
allow: calcium hydroxide / lime / milk of lime / other carbonates
allow: correct formulae

(d) H_2 (on right); [1]
correct balance (i.e. 2 on left); [1]

(e) **(i)** molecular formula of ethanoic acid is $C_2H_4O_2$; [1]
full structural formula of ethanol is: [1]



allow: OH in place of O- H

(ii) $C_2H_4 + H_2O$; [1]

[Total: 14]

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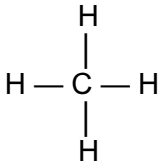
4 **(a)** bitumen → surfacing roads; [1]
lubricating fraction → waxes and polishes; [1]
refinery gases → heating; making chemicals [1]
allow: refinery gas → making chemicals
naphtha → making chemicals; [1]

(b) substance containing hydrogen and carbon only; [1]

(c) **(i)** [1]



(ii) CO_2 (on right); [1]

correct balance (i.e. 2 on left) [1]

note: balance mark dependent on CO_2 on right

(iii) any two of: [2]
family of similar (organic) compounds /

with similar chemical properties /

presence of same functional group /

same general formula /

allow: compounds with a trend in physical properties
allow: difference of CH_2 between one member and another

(iv) ethane; [1]

[Total: 11]

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5 **(a)** lower the test tube (into the HC*l*) / mix the reactants / mix the zinc and hydrochloric acid; [1]

(b) **(i)** all points plotted correctly including the 0-0 point; [2]
note: –1 per error

curve of best fit drawn; [1]

(ii) because the reaction has finished / reaction has stopped / reaction is complete; [1]

the hydrochloric acid has been used up / hydrochloric acid is limiting / the limiting reagent has been used up; [1]
reject: the zinc has been used up / the zinc and hydrochloric acid have been used up

(c) concentration; increases; decreases; speed; (1 mark each) [4]

(d) filter (off excess zinc) / decant (off solution); [1]
note: if no filtration or decantation no further marks can be scored

heat filtrate to crystallisation point / evaporate some of the water / heat for a little while / leave filtrate in a warm place / leave on the windowsill; [1]

dry crystals with filter paper; [1]
allow: dry in oven below 100°C

[Total: 13]

6 **(a)** **(i)** lithium + water → lithium hydroxide + hydrogen [2]
note: –1 per error

(ii) $2Na + 2H_2O \rightarrow 2NaOH + H_2$ [1]
allow: equations doubling or halving all species

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(b) 2 marks for order of reactivity:
- order of reactivity is potassium > sodium > lithium / implication of rate of bubble formation or some other observation clearly shows the order is potassium > sodium > lithium; [2]

note: reactivity increases down group / only two of the elements are named but they are in correct order of reactivity e.g. potassium is more reactive than sodium = 1 mark

3 marks for observations: [3]
any 3 of:
- float on surface (with any of the 3 elements)
- bubbles given off / effervescence (with any of the 3 elements)
- fizzes / sound heard (with any of the 3 elements)
- Na / K go into a ball OR Na / K melt **ignore:** Li goes into ball or melts

allow: they go into a ball
- move across the surface of the water) (with any of the 3 elements)
- K (bursts into) flame
- lilac / violet flame for K

allow: Na (bursts into) flame / yellow flame
- Na / K spits / explodes (when gets very small) **allow:** pops or sparks (for Na or K)
- Li / Na / K disappears / gets smaller

(c) (i) anode: E; [1]
electrolyte: A; [1]

(ii) + electrode: chlorine / Cl_2; [1]
– electrode: sodium / Na; [1]
reject: ions / chloride

(iii) graphite; [1]

(d) any two of: [2]
- shiny (when cut)
- conduct heat
- conduct electricity
- malleable / soft / easy to cut
- ductile

[Total: 15]

7 (a) (i) sulfur + oxygen → sulfur dioxide [2]
(sulfur + oxygen → sulfur oxide / sulfur trioxide) = 1 mark

(ii) SO_2 oxidised to SO_3 / 1st box ticked; [1]
O_3 reduced to O_2 / 3rd box ticked; [1]

(iii) H_2O; [1]

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(b) any 3 of; [3]

- (sulfuric acid) reacts (with calcium carbonate)
- neutralisation (reaction)
- gas released / CO_2 released
- soluble substances formed (on reaction)
- buildings eroded / (surface) crumbled / damaged / pitted /

note: a correct word or symbol equation = 2 marks
note: neutralisation reaction = 2 marks

(c) kills (or harms) organisms in lakes / forest death / deforestation / kills trees / kills plants / damages plants / irritation of throat or lungs / reference to asthma; [1]
allow: kills (or harms) animals or fish in lakes or rivers / kills corals.
allow: leaches soil minerals
allow: leaf burn
ignore: kills animals / fish in the sea / kills fish unqualified
ignore: acidifies soil / acidifies lakes
ignore: wears away / erodes carbonate rocks / erodes soil
ignore: destroys plants / animals

[Total: 9]

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