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

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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.

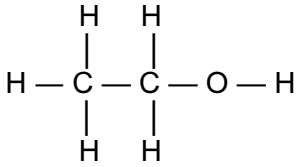
(c) **(i)** calcium carbonate + hydrochloric acid → calcium chloride + carbon dioxide + water [3]
note: –1 per error

(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]

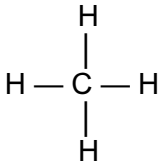
[Total: 14]

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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 $\rightarrow$ 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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