CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2014 series

0620 CHEMISTRY

0620/32 Paper 3 (Extended 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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CAMBRIDGE
International Examinations

1 **(a)** A and E **need both** (1) [1]

(b) D (1) [1]

(c) C (1) [1]

(d) B (1) [1]

(e) F (1) [1]

(f) E (1) [1]

(g) C (1) [1]

[Total: 7]

2 **(a)** **(i)** substance / material / compound / element / mixture (burnt) to <u>produce / release energy **or** heat</u> (1) [1]

(ii) Any **two** from:
coal
coke
peat
petroleum / crude oil
refinery gas / LPG
gasoline / petrol
naptha
kerosene / paraffin
diesel (oil) / gas oil
fuel oil
propane
butane [2]

(iii) wood / charcoal / animal dung / biomass / Uranium / U / plutonium / Pu (1) [1]

(b) (i) any **two** from:
water / steam / water vapour / H_2O (1)
carbon dioxide / CO_2 (1)
carbon monoxide / CO (1) [2]

(ii) any **two** from:

limited or finite resource / non-renewable / will run out / depleted (1)

greenhouse effect / gas(es) / climate change / (cause) global warming (1)

acid rain (1)

production of poisonous / toxic gases (1) [2]

[Total: 8]

3 (a) (i) pressure 150–300 atmospheres / atm (1)

temperature **accept** in range 370 to 470 °C (1)

iron (catalyst) (1)

balanced equation $N_2 + 3H_2 \rightleftharpoons 2NH_3$ (1)

equilibrium / reversible (1) [5]

(ii) potassium / K (1)

phosphorus / P (1) [2]

(b) (i) burn fossil fuels / burn fuels containing sulfur / burn compounds containing sulfur / burn ores containing sulfur / roast metal sulfides / burn metal sulfides (1)

sulfur dioxide / SO_2 (formed) (1)

(form) sulfuric / H_2SO_4 / sulfurous acid / H_2SO_3 (1)

OR

nitrogen and oxygen (in air) react at high temperatures / in jet engines / car engines / lightning. (1)

(form) oxides of nitrogen (1)

(form) nitric acid / HNO_3 / nitrous acid / HNO_2 (1) [3]

(ii) any **two** from:
calcium oxide / lime / quicklime / CaO (1)
calcium hydroxide / $Ca(OH)_2$ / lime / slaked lime / limewater (1)
calcium carbonate / $CaCO_3$ / limestone / chalk / marble (1) [2]
guidance: 'lime' can only be credited once.

[Total: 12]

4 (a) (i) butanoic / butyric acid (1)

$CH_3CH_2CH_2COOH$ / $C_2H_5CH_2COOH$ (1) [2]

(ii) any **three** from:

(same) general formula (1)

(consecutive members) differ by CH_2 (1)

same functional group (1)

common methods of preparation (1)

physical properties vary in predictable manner / show trends / gradually change
or example of a physical property variation i.e. melting point / boiling point / volatility (1) [3]

(b) (i) displayed formula of propan-1-ol, all bonds shown separately (1) [1]

(ii) acidified (1)

potassium manganate(VII) / potassium permanganate / $KMnO_4$ **or** potassium dichromate(VI) / $K_2Cr_2O_7$ / potassium dichromate (1) [2]

(c) (i) zinc + propanoic acid → zinc propanoate (+ hydrogen) (1) [1]

(ii) calcium oxide + propanoic acid → calcium propanoate + water (1) [1]

(iii) $LiOH + CH_3CH_2COOH \rightarrow CH_3CH_2COOLi + H_2O$ (1) [1]

(d) (i) concentration (of acid in C) is less / halved **or** concentration of A is more / doubled. (1)

less collisions **or** more collisions in A (than in C) (1) [2]

(ii) (higher temperature in B particles / molecules / atoms) move faster / have more energy / more have E_a **or** (particles / molecules / atoms) in A move slower / have less energy / less have E_a (1)

more collisions **or** less collisions in A (than in B) (1) [2]

(iii) It (D) has strong (acid) **and** A has weak acid / (D) stronger / (D) ionises more / (D) dissociates more **or** A is weaker / A ionises less / A dissociates less (1)

It (D) has higher concentration of hydrogen ions **or** A has a lower concentration of hydrogen ions (1)

more collisions (in D) **or** fewer collisions in A (1) [3]

[Total: 18]

5 (a) (i) incomplete combustion **or** limited oxygen / less oxygen / not enough oxygen (1) [1]

(ii) any **two** from:

(forward) reaction is endothermic (1)

high temperature increases yield / favours forward reaction / shifts equilibrium to right (1)

faster reaction (rate) (1) [2]

(iii) any **two** from:

high pressure reduces yield **or** favours LHS (1)

because LHS has smaller volume **or** number of moles / number of molecules (of gas) ORA (1)

(high pressure plant is) expensive / dangerous / explosion / leaks [2]

5 (b) hydrogen **and** chlorine / H_2 **and** Cl_2 (1)

sodium hydroxide / NaOH / Na^+OH^- (1)

$2H^+ + 2e \rightarrow H_2$ / $2H^+ \rightarrow H_2 - 2e$ (1)

$2Cl^- \rightarrow Cl_2 + 2e$ / $2Cl^- - 2e \rightarrow Cl_2$ (1)

Hydrogen / H_2 / H / H^+ at cathode **and** chlorine / chloride / Cl_2 / Cl / Cl^- at anode (1) [5]

5 (c) each chlorine 1 bond pair and 3 non-bond pair (1)

oxygen atom 2 non-bond pairs and 2 bond pairs as double bond (1)

carbon atom 4 bond pairs including 2 bond pairs as double bond (1) [3]

[Total: 13]

6 **(a)** any **three** from:
(it would have) more than one or variable valency / oxidation state / oxidation number (1)

(metal / element / titanium / it has a) high density (1)

coloured compounds / ions / solutions (1)

form complex (ions) (1)

(element/compound act as) catalyst (1) [3]

(b) ScF_3 (1)

correct charges on **both** ions (1)

8 electrons around (each) fluoride (1) [3]

(c) name or formula of strong acid and alkali (1)

reacts with or neutralises both acid and base or alkali (then amphoteric) (1)

it dissolves / soluble in both(acid and alkali) or form solutions in both (1) [3]

[Total: 9]

7 **(a)** repeat without indicator / repeat using same volumes of acid and alkali **or** use carbon / charcoal to remove indicator (1)

evaporate / heat / warm / boil / leave in sun (1)

until most of the water has gone / some water is left / saturation (point) / crystallisation point (1)

leave / allow to cool / allow to crystallise (1)

filter (off crystals) / wash(with distilled water) / dry crystals with filter paper / dry crystals in warm place / oven / windowsill (1) [5]

(b) 0.062 (1)

0.031 (1)

3.97 g (1)

55.4% (1) [4]

(c) (i) (to prove) **all** water driven off or evaporated or boiled / no water remains / to make salt anhydrous (1)

(ii) $m_1 - m_2$ = mass of water (1)

(calculate) moles of water **AND** moles of hydrated or anhydrous salt (1)

1:1 ratio / should be equal (1) [3]