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

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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]

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(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]

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(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]

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(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]

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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]

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(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]

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