CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the October/November 2012 series

0620 CHEMISTRY

0620/33 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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1 **(a)** Ca / calcium; [1]

(b) Kr / krypton; [1]

(c) Ge / germanium; [1]

(d) Ni / nickel **or** Cr / chromium; [1]

(e) Br / bromine / Br_2; [1]

(f) Se / selenium; [1]

(g) Cu / copper; [1]

(h) Br / bromine / Br_2; [1]

[Total: 8]

2 **(a)** **(i)** manufacture of plastics / (solvents for) dry cleaning / metal degreasing / textiles / agrochemicals / pharmaceuticals / insecticides / dyestuffs / household cleaning products / bleach / water treatment / swimming pools / kill bacteria or germs or microorganisms or pathogens / sterilisation / disinfectants; [1]

(ii) electric light bulbs / fluorescent tubes / (inert gas shield for) arc welding / production of titanium / inert atmosphere / car headlights / food packaging; [1]

(iii) (manufacture of) polyethene / polyvinyl chloride (PVC) / making polymers / (to prepare) epoxyethane (which is used in the manufacture of detergents / (to make) ethylene glycol (which is used to prepare Terylene) / (to make) anti-freeze / or making ethanol (accept making alcohol) / ripening fruits; [1]

(iv) (making) steel / (oxy-acetylene) welding / cutting of metals / medical or diving or (oxygen tanks in) hospitals / astronauts / (deep sea) diving / fire fighters; [1]

(b) liquid air; [1]
fractional distillation; [1]

[Total: 6]

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3 (a) explanation of evaporation e.g. particles (or molecules) with a lot of energy leave the liquid / bromine particles break free from each other / forces or bonds between bromine molecules broken / molecules (in liquid) have weak forces holding them together / weak intermolecular forces / Van der Waals forces between molecules (don't have to be stated as weak) / (weak intermolecular forces alone scores this mark);
allow: particles (or molecules) of bromine escape from liquid [1]

diffusion / diffuse / movement of particles; [1]

explanation of diffusion involving qualified movement of molecules / particles
i.e. random movement of molecules / particles move in all directions; [1]

(b) air more dense / heavier / higher M_r than hydrogen; [1]
hydrogen diffuses faster (than air diffuses out); [1]
accept: diffusion in is faster than out (without naming gases)
pressure inside pot is greater (than outside); [1]
air less dense / lighter / lower M_r than carbon dioxide; [1]

air diffuses / moves faster (than carbon dioxide); [1]
accept: diffusion out is faster than in (without naming gases)

pressure inside pot less (than outside); [1]

ORA in both parts

[Total: 9]

4 (a) (i) zinc mixed with an element(s) or metal(s) or non-metal; [1]

(ii) galvanising / baths / coating steel (i.e. description of galvanising) / roofing / sacrificial protection / protection from rusting / electroplating / zinc plating / batteries; [1]

(iii) (lattice) positive ions / cations / metal ions / sea of electrons / delocalised or free or mobile or moving electrons; [1]
attraction between positive ions and electrons; [1]
the layers (of ions) or particles can slide or slip or shift past each other; [1]

(iv) different atom / ion / particle of different size; [1]
prevents (layers / atoms / ions / particles / molecules) moving / slipping / sliding / shifting; [1]

(b) (i) heat with carbon or coke or carbon monoxide; [1]

(ii) $ZnO + H_2SO_4 \rightarrow ZnSO_4 + H_2O$ [2]
[1] for correct reactants [1]for correct products

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(iii) zinc (**not:** ions) more reactive than silver and lead; [1]
zinc displaces both metals / silver **and** lead produced / ions become atoms / zinc reduces silver ions and lead ions; [1]
(silver and lead) can be removed by filtering / centrifugation / decanting; [1]

an ionic equation; i.e.
$Zn + 2\ Ag^+ \rightarrow Zn^{2+} + 2Ag$ or $Zn + Pb^{2+} \rightarrow Zn^{2+} + Pb$ [1]
allow: any two correct half equations

(iv) cathode labelled carbon / zinc / platinum; [1]
zinc deposited at cathode; [1]
oxygen formed (at anode); [1]
(electrolyte becomes) sulfuric acid / remaining solution contains H^+ and SO_4^{2-}; [1]

[Total: 18]

5 (a) (i) add bromine water / bromine / aqueous bromine; [1]
colourless; [1]

or add potassium manganate(VII) / permanganate; (ignore acid or alkali) [1]
colourless; [1]

(ii) add metal / carbonate / insoluble base / strong alkali **allow:** ammonia with an indicator / use pH meter; [1]
COND: on reagent

metal - hydrogen given off / metal dissolves / effervescence / gas given off / burning splint pops;

carbonate - carbon dioxide given off / effervescence / gas given off / limewater milky;

insoluble base - solution formed / dissolves;

alkali - use of indicator to show neutralisation / temperature increase;

pH meter - gives pH less than 7 [1]

(b) ethyl propenoate; [1]
correct SF all bonds shown;; [2]
allow: [1] for correct displayed ester linkage

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(c) **(i)** number of atoms of each element; [1]
in one molecule; [1]

(ii) 2; [1]

(iii) C=C [1]

(iv) $HOOC(CH_3)C=C(CH_3)COOH$

[Total: 12]

6 **(a)** **(i)** $Zn + 2HCl \rightarrow ZnCl_2 + H_2$ [2]
not balanced = [1]

(ii) 3 bps and 1 nbp around As; [1]
1 bp each hydrogen atom; [1]

(b) **(i)** (97.4 / 75 =) 1.3 **and** (2.6 / 1 =) 2.6; [1]
empirical formula AsH_2; [1]
note: correct formula with no working = [1]

(ii) As_2H_4; [1]

(iii) $H_2As–AsH_2$ / $AsH_2–AsH_2$; [1]

(c) **(i)** amide / peptide; [1]

(ii) named strong acid / alkali; [1]
allow: HCl / enzymes

(iii) amino acid; [1]
allow: peptides

(d) **(i)** Cu and As have more than one oxidation state / valency; [1]

(ii) $3Cu^{2+} + 2AsO_4^{3-} \rightarrow Cu_3(AsO_4)_2$ [2]
either side correct = [1]

[Total: 14]

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7 **(a)** (making) fertilisers / nitric acid / nylon / refrigeration / explosives / cleaning products; [1]

(b) alkane / named alkane; [1]
water / steam; [1]
heat / catalyst; [1]

or electrolysis; [1]
suggest suitable electrolyte; (**allow:** water) [1]
hydrogen at cathode; [1]

or cracking; [1]
alkane / named alkane; [1]
heat or catalyst [1]

(c) any five from:
faster; (rate) [1]

more collisions / molecules closer together / more particles per unit volume; [1]

(collisions) more frequent / more often / more chance / more effective or successful collisions / more collisions with Ea / increase rate of collisions; [1]

higher yield / moves (equilibrium) to RHS / more ammonia / to side of products / high pressure favours the reaction with less moles; [1]

less moles / molecules / volume on RHS ORA (can be implied in previous comments) [1]

high pressure means lower temperature can be used to achieve comparable rate (thus saving energy); [1]

7 **(d)** **(i)** endothermic takes in / absorbs / uses / needs / gains energy / heat **and** exothermic gives out / loses energy / heat; [1]

(ii) 2328 (ignore + or –) / 6 × 388 (not evaluated); [1]

944 + 1308 / 2252 **and** endothermic and exothermic in table; [1]

2328>2252 or (–) 76 kJ; [1]

or energy of products / RHS > reactants / LHS
or energy needed to break bonds < energy given out on formation of bonds.

[Total: 13]

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