CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2014 series

0620 CHEMISTRY

0620/31 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.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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CAMBRIDGE
International Examinations

1 **(a)** A, D, E (1)

same number of protons and electrons / electrically neutral (1) [2]

(b) C (1)

more electrons than protons / $36e^-$ and $34p^+$ / it has gained electrons (1) [2]

(c) B, F (1) [1]

(d) they have same number of protons (1)

different number of neutrons / neutron number (1) [2]

[Total: 7]

2 **(a)** **(i)** filtration (1)

chlorination (1) [2]

(ii) Any **two** from: [2]
- manufacture of ethanol
- used in the manufacture of sulfuric acid **or** in the Contact process
- manufacture of hydrogen **or** ammonia **or** for the Haber process

(iii) Any **two** from: [2]
- cooking
- washing or laundry
- drinking
- toilets
- watering plants
- (domestic) heating

(b) boiling or turning to steam (1)

then condensing / condensation (1) [2]

[Total: 7]

3 **(a)** **(i)** (particles) spread to fill total available volume / move from high concentration to low concentration / moves down a concentration gradient (1) [1]

(ii) mass or M_r (1) [1]

(b) **(i)** helium atoms / molecules are lighter than molecules in air or N_2 **and** O_2
or helium is less dense than air or N_2 **and** O_2.
or helium diffuses (through the porous barrier) faster than air or N_2 **and** O_2. (1) [1]

(ii) faster rate of diffusion / molecules move faster (at high temperatures). (1) [1]

(c) (i) $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ (1) [1]

(ii) would get a mixture of helium and carbon dioxide
or would get a mixture of gases
or waste of methane / natural gas / fossil fuel (1) [1]

(iii) <u>fractional</u> distillation (1) [1]

[Total: 7]

4 (a) (i)

Group number	I	II	III	IV	V	VI	VII
symbol	Na	Mg	Al	Si	P	S	Cl
number of valency electrons	1	2	3	4	5	6	7
valency	1	2	3	4	3	2	1

(1) for each line [2]

(ii) number of valency electrons = the group number (1) [1]

(iii) for Na to Al
the valency is the same as the number of valency (outer) electrons (1)

(because) this is the number of electrons **lost** (for full energy level) (1)

for P to Cl
the valency is 8 – [number of valency (outer) electrons]
or valency + valency electrons = 8 (1)

(because) this is number of electrons **needed** (or to be **gained**) (for full energy level) (1)

(b) (i) Assume change is from L to R unless clearly stated:
basic to amphoteric to acidic (2) [2]

(ii) ionic (metal) chlorides on the left (1)
covalent (non-metal) chlorides on the right (1) [2]

[Total: 11]

5 **(a)** M1: (zinc sulfide) heated / roasted / burnt in **air** (1)

M2: zinc oxide formed (1)

M3: zinc oxide **reduced** (1)

M4: (by adding) coke or carbon (1)

M5: Balanced equation (any one of) (1) [5]

$2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$
$2ZnO + C \rightarrow 2Zn + CO_2$
$ZnO + C \rightarrow Zn + CO$
$ZnO + CO \rightarrow Zn + CO_2$

(b) Any **two** from: [2]

- (making) brass **or** alloys (1)
- galvanising (1)
- sacrificial protection (1)
- batteries (1)

[Total: 7]

6 **(a)** **(i)** rate at t_2 less than at t_1 **or** the rate decreases (1)

rate at t_3 zero / reaction stopped (1) [2]

(ii) rate at t_2 less than at t_1 because **concentration** of hydrogen peroxide is less at t_2 **or concentration** of hydrogen peroxide is decreasing. (1)

(rate at t_3 zero / reaction stopped because) hydrogen peroxide is used up (1) [2]

(b) **(i)** steeper and must come from the origin (1)
final volumes the same (1) [2]

(ii) Any **two** from: [2]
steeper curve because of a faster rate
faster rate because of increased surface area
same amount / volume / mass / no of mol of hydrogen peroxide
ecf for M1 for a shallower curve because of slower rate.

(c) filter (and rinse / wash) (1)

dry manganese (IV) oxide (1)

weigh / measure mass manganese(IV) oxide after reaction (1)

the mass should be 0.1 g **or** unchanged. (1) [4]

(d) number of moles of O_2 formed = 0.096 / 24 = 0.004 (1)
number of moles of H_2O_2 in 40 cm^3 of solution = $0.004 \times 2 = 0.008$ (1)

concentration of the hydrogen peroxide in mol / dm^3 = 0.008 / 0.04 = 0.2 (1) [3]

[Total:15]

7 (a) (i)

aqueous solution	lead Pb	magnesium Mg	zinc Zn	silver Ag
lead (II) nitrate		✓	✓	✗
magnesium nitrate	✗		✗	✗
zinc nitrate	✗	✓		✗
silver(I) nitrate	✓	✓	✓	

each horizontal line correct (1) [3]

(ii) Zn (1)

An arrow **from** Zn **to** Zn^{2+} (1) [2]

(iii) $Zn + 2Ag^+ \rightarrow Zn^{2+} + 2Ag$ (1) [1]

(b) (i) correct direction from zinc to lead (1) [1]

(ii) metals react by **losing electrons** (1)

the more reactive metal / zinc will lose electrons more readily (making the electrode negatively charged). (1) [2]

(iii) manganese **and** zinc are more reactive than lead (and / or copper) (1)

lead is more reactive than copper (1) [2]

(iv) the **polarity** of a Mn / Zn (cell)
or the **voltages** of Zn / Pb **and** Mn / Pb (cells) (1) [1]

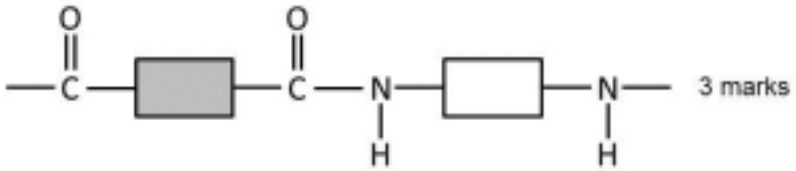
[Total: 12]

8 (a) (i) $CH_3–CH=CH–CH_3$ (1) [1]

(ii) one correct amide linkage between two rectangles (1)

correct sequencing of a second amide link and monomers (1)

two correct amide links **and** rest of structure correct (including additional monomers if seen) **and** correct continuation bonds (1) [3]



(iii) protein **or** polypeptide **or** named protein (1) [1]

(iv) addition: **only** the polymer **or** one product is formed (1)

condensation: the polymer **and** a small molecule / water / HC*l* is formed (1) [2]

(b) (i) does not break down **or** rot **or** decompose (1)

by microbes **or** fungi **or** bacteria **or** by living organisms (1) [2]

(ii) Any **three** from: [3]
visual pollution (1)

(shortage of) landfill sites (1)

danger to wildlife / animals (including at sea) (1)

toxic gases when burnt **or** greenhouse gases produced when burned (1)

(c) Any **two** from: [2]
resistant to corrosion / unreactive to water / more durable (1)

lighter / less dense (1)

easier to manufacture / can be moulded (1)

good insulator / keeps the water cold (1)

[Total: 14]