CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2014 series

0439 CHEMISTRY (US)

0439/31 Paper 3 (Extended Theory), maximum raw mark 80

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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]

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(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]

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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.

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(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 × 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]

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(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]

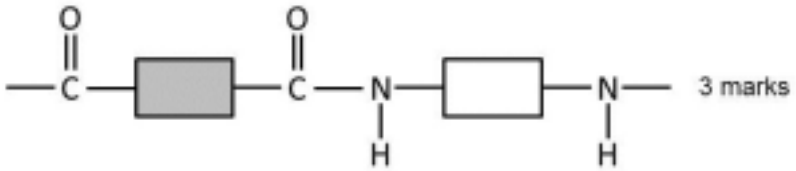
[Total: 12]

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]

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