UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the October/November 2010 question paper for the guidance of teachers

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)** to complete the outer shell (of oxygen) / full outer or valence shell / 8 (electrons) in outer shell / Noble gas structure / to complete outer shell / to complete the octet
ignore reference to hydrogen atoms / reference to accepting / sharing or gaining electrons [1]

(b) loses (one) electron [1]
not loses electron**s**

(c) opposite charges attract / electrostatic attraction / positive attracts negative / + and – attract [1]

(d) in solid ions cannot move / flow / no free ions / ions in a lattice [1]
in solution ions can move / flow / mobile ions / ions free (to move) [1]

[Total: 5]

2 **(a)** 23p 23e 28n [1]
23p 20e 28n [1]
23p 23e 27n [1]

(b) **(i)** (contains) iron [1]
cond with other element(s) / compounds / suitable named element [1]
if iron is absent = 0

(ii) mild steel [1]
cars / fridges / white goods / construction etc. [1]
credit any sensible suggestion e.g. roofing, nails, screws, radiators
or
stainless steel [1]
cutlery / chemical plant / jewellery / (kitchen) utensils / named kitchen utensil / in cars / surgical equipment / car exhausts etc. [1]
not vanadium steel (this is in the question)

(c) **(i)** V_2O_3 [1]
VO_2 [1]

(ii) add sodium hydroxide(aq) or other named alkali [1]
not ammonia
cond vanadium(IV) oxide dissolves / reacts [1]
filter (to remove vanadium(III) oxide) [1]

[Total: 12]

3 (a) (i) silver, tin (cobalt and magnesium not possible to decide) [2]
for silver less reactive then tin = 1

(ii) magnesium and cobalt salt / compound / ions
or
cobalt and magnesium salt / compound / ions [1]

(iii) $Sn + 2Ag^+ \rightarrow Sn^{2+} + 2Ag$ [2]
all species correct = 1 balancing = 1
Sn to Sn^{2+} oxidation (can be written separately or as a correct half-equation) [1]

(b) no reaction [1]
$Mg(OH)_2 \rightarrow MgO + H_2O$ accept multiples [1]

(c) (i) it forms positive ions / loses or gives electrons [1]
electrons move / flow from this electrode / enter the circuit / electrons flow from negative to positive (so it is negative) [1]

(ii) bigger voltage of Zn/Cu cell than Sn/Cu cell
or
zinc is negative relative to tin (in the third cell) [1]

(iii) magnesium / more reactive metal (must be named) instead of zinc
not anything above calcium in the reactivity series
or
silver / less reactive metal (must be named) instead of copper
or
use (more) concentrated acid [1]

(iv) polarities correct that is Zn - and Sn + [1]
0.6 V [1]

[Total: 14]

4 (a) (i) H_2 on RHS [1]
ignore any other species on RHS
rest of equation fully correct i.e. $2H^+ + 2e \rightarrow H_2$ [1]

(ii) H^+ removed / escapes / discharged / used up / reduced [1]
(equilibrium) moves to RHS / more water molecules ionise or dissociate / forward reaction favoured [1]

(iii) oxygen / O_2 [1]
not O

(iv) carbon / graphite / platinum (electrode) [1]

(b) (i) to make ammonia / in petroleum processing / balloons / rocket fuel / fuel for cars / hardening of fats / fuel cells / fuel (unqualified) / making hydrochloric acid [1]

(ii) to sterilise / disinfect it / kill bacteria / bugs / microbes / micro-organisms / germs [1]

(c) (i) (reference to) volume and time / how long it takes [1]

(ii) carry out experiment with different intensities of light / one in light and one in dark / repeat experiment in reduced light [1]
measure new rate which would be faster or slower depending on light intensity [1]

[Total: 11]

5 (a) (i) $Mg + 2CH_3COOH \rightarrow (CH_3COO)_2Mg + H_2$ [1]
correct formula of magnesium ethanoate [1]
ignore charges

sodium ethanoate + water [1]

(ii) ethyl ethanoate [1]
displayed formula [1]

(b) (i) add up to 5.8 g [1]

(ii) moles of C atoms = 2.4/12 = 0.2
moles of H atoms = 0.2/1 = 0.2
moles of O atoms = 3.2/16 = 0.2
all three correct = 2 [2]
two correct = 1
empirical formula CHO [1]

(iii) 116/29 = 4 [1]
$C_4H_4O_4$ [1]
correct formula with no working scores both marks.

(iv) $HOOCCH=CHCOOH$ / $CH_2=C(COOH)_2$ [2]

[Total: 13]

6 (a) (i) 6e between two nitrogen atoms (can be any combination of dots or crosses) [1]
1 lone pair on each nitrogen atom [1]

(ii)

	SOLID	GAS	
PATTERN	regular / lattice (**not** fixed)	random / irregular / no pattern	[1]
DISTANCE	close	far apart / spread out	[1]
MOVEMENT	vibrate / fixed / no motion	moving / translational	[1]

(b) (i) **particles/molecules** have more energy / move faster [1]
collide harder / collide more frequently / more collisions / collide with more force (with the walls) [1]

(ii) (1) nitrogen has small**er** M_r / light**er** molecules / low**er** density [1]
nitrogen **molecules** / **particles** **move** fast**er** (than chlorine molecules) [1]

(2) at higher temperature nitrogen **molecules or particles** (not atoms) move faster / have more energy [1]

[Total: 10]

7 (a) (i) lighter / light / lightweight / lower density [1]
does not corrode / rust / oxidised [1]
ignore cheaper / easier to mould

(ii) credit any two sensible suggestions e.g. rope / clothing / netting / string / carpets / fishing line / fishing nets / parachutes / tyres / tents / bottles / thread / umbrellas / curtains / toothbrushes / cassettes / video tapes [2]

(iii) non-biodegradeable / do not rot / do not decompose / persist for years / accumulate
landfill sites limited / getting filled up
visual pollution
danger to fish / animals
(burn to form) toxic gases / harmful gases / pollutant gases / acidic gases / CO / HC*l* / HF / HCN
not oxides of nitrogen / sulfur
any three [3]

(b) (i) propene / propylene [1]
accept prop-1-ene
not prop-2-ene
CH_3-CH=CH_2 [1]
double bond must be shown

(ii) correct repeat unit (one or more **whole** repeat units must be given) [1]
cond continuation [1]

(c) (i) amide / peptide / polypeptide [1]

(ii) protein / polypeptide [1]

(iii) $H_2N(CH_2)_6NH_2$ [1]
$HOOC(CH_2)_8COOH$

[Total: 15]