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

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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 <u>salt / compound / ions</u>
or
cobalt and magnesium <u>salt / compound / ions</u> [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 <u>positive</u> 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) <u>H^+</u> 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 fast**er** or slow**er** 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]