## 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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| Page 2 | Mark Scheme: Teachers' version | Syllabus | Paper |
| :---: | :---: | :---: | :---: |
|  | IGCSE - October/November 2010 | 0620 | 33 |

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
not loses electrons
(c) opposite charges attract / electrostatic attraction / positive attracts negative / + and - attract
(d) in solid ions cannot move / flow / no free ions / ions in a lattice
in solution ions can move / flow / mobile ions / ions free (to move)
[Total: 5]

2 (a) 23p 23e 28n
23p 20e 28n
23p 23e 27n
(b) (i) (contains) iron
cond with other element(s) / compounds / suitable named element
if iron is absent $=0$
(ii) mild steel
cars / fridges / white goods / construction etc.
credit any sensible suggestion e.g. roofing, nails, screws, radiators
or
stainless steel
cutlery / chemical plant / jewellery / (kitchen) utensils / named kitchen utensil / in cars / surgical equipment / car exhausts etc.
not vanadium steel (this is in the question)
(c) (i) $\mathrm{V}_{2} \mathrm{O}_{3}$
$\mathrm{VO}_{2}$
(ii) add sodium hydroxide(aq) or other named alkali
not ammonia
cond vanadium(IV) oxide dissolves / reacts
filter (to remove vanadium(III) oxide)
[Total: 12]

| Page 3 | Mark Scheme: Teachers' version | Syllabus | Paper |
| :---: | :---: | :---: | :---: |
|  | IGCSE - October/November 2010 | 0620 | 33 |

3 (a) (i) silver, tin (cobalt and magnesium not possible to decide)
for silver less reactive then tin $=1$
(ii) magnesium and cobalt salt / compound / ions
or
cobalt and magnesium salt / compound / ions
(iii) $\mathrm{Sn}+2 \mathrm{Ag}^{+} \rightarrow \mathrm{Sn}^{2+}+2 \mathrm{Ag}$
all species correct $=1 \quad$ balancing $=1$
Sn to $\mathrm{Sn}^{2+}$ oxidation (can be written separately or as a correct half-equation)
(b) no reaction
$\mathrm{Mg}(\mathrm{OH})_{2} \rightarrow \mathrm{MgO}+\mathrm{H}_{2} \mathrm{O}$ accept multiples
(c) (i) it forms positive ions / loses or gives electrons
electrons move / flow from this electrode / enter the circuit / electrons flow from negative to positive (so it is negative)
(ii) bigger voltage of $\mathrm{Zn} / \mathrm{Cu}$ cell than $\mathrm{Sn} / \mathrm{Cu}$ cell
or
zinc is negative relative to tin (in the third cell)
(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
(iv) polarities correct that is Zn - and $\mathrm{Sn}+$
0.6 V
[Total: 14]

4 (a) (i) $\mathrm{H}_{2}$ on RHS
ignore any other species on RHS
rest of equation fully correct i.e. $2 \mathrm{H}^{+}+2 \mathrm{e} \rightarrow \mathrm{H}_{2}$
(ii) $\underline{\mathrm{H}}^{+}$removed / escapes / discharged / used up / reduced
(equilibrium) moves to RHS / more water molecules ionise or dissociate / forward reaction favoured
(iii) oxygen / $\mathrm{O}_{2}$
not $O$
(iv) carbon / graphite / platinum (electrode)
(b) (i) to make ammonia / in petroleum processing / balloons / rocket fuel / fuel for cars / hardening of fats / fuel cells / fuel (unqualified) / making hydrochloric acid
(ii) to sterilise / disinfect it / kill bacteria / bugs / microbes / micro-organisms / germs

| Page 4 | Mark Scheme: Teachers' version | Syllabus | Paper |
| :---: | :---: | :---: | :---: |
|  | IGCSE - October/November 2010 | 0620 | 33 |

(c) (i) (reference to) volume and time / how long it takes
(ii) carry out experiment with different intensities of light / one in light and one in dark / repeat experiment in reduced light
measure new rate which would be faster or slower depending on light intensity
[Total: 11]

5 (a) (i) $\mathrm{Mg}+2 \mathrm{CH}_{3} \mathrm{COOH} \rightarrow\left(\mathrm{CH}_{3} \mathrm{COO}\right)_{2} \mathrm{Mg}+\mathrm{H}_{2}$
correct formula of magnesium ethanoate
ignore charges
sodium ethanoate + water
(ii) $\begin{aligned} & \text { ethyl ethanoate } \\ & \text { displayed formula }\end{aligned}$
(b) (i) add up to 5.8 g
(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 $=2$
two correct = 1
empirical formula CHO
(iii) $116 / 29=4$
$\mathrm{C}_{4} \mathrm{H}_{4} \mathrm{O}_{4}$
correct formula with no working scores both marks.
(iv) $\mathrm{HOOCCH}=\mathrm{CHCOOH} / \mathrm{CH}_{2}=\mathrm{C}(\mathrm{COOH})_{2}$
[Total: 13]

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

PATTERN regular / lattice (not fixed) random / irregular / no pattern
DISTANCE close far apart / spread out
MOVEMENT vibrate / fixed / no motion moving / translational
(b) (i) particles/molecules have more energy / move faster
collide harder / collide more frequently / more collisions / collide with more force (with the walls)

| Page 5 | Mark Scheme: Teachers' version | Syllabus | Paper |
| :---: | :---: | :---: | :---: |
|  | IGCSE - October/November 2010 | 0620 | 33 |

(ii) (1) nitrogen has smaller $M_{r}$ / lighter molecules / lower density
nitrogen molecules / particles move faster (than chlorine molecules)
(2) at higher temperature nitrogen molecules or particles (not atoms) move faster / have more energy
[Total: 10]

7 (a) (i) lighter / light / lightweight / lower density does not corrode / rust / oxidised
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
(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 / HCl / HF / HCN
not oxides of nitrogen / sulfur
any three
(b) (i) propene / propylene
accept prop-1-ene
not prop-2-ene
$\mathrm{CH}_{3}-\mathrm{CH}=\mathrm{CH}_{2}$
double bond must be shown
(ii) correct repeat unit (one or more whole repeat units must be given)
cond continuation
(c) (i) amide / peptide / polypeptide
(ii) protein / polypeptide
(iii) $\mathrm{H}_{2} \mathrm{~N}\left(\mathrm{CH}_{2}\right)_{6} \mathrm{NH}_{2}$
$\mathrm{HOOC}\left(\mathrm{CH}_{2}\right)_{8} \mathrm{COOH}$

