

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 electrons
- (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]**

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- 3 (a) (i) silver, tin (cobalt and magnesium not possible to decide) [2]  
for silver less reactive than tin = 1
- (ii) magnesium and cobalt salt / compound / ions  
**or**  
cobalt and magnesium salt / compound / ions [1]
- (iii)  $\text{Sn} + 2\text{Ag}^+ \rightarrow \text{Sn}^{2+} + 2\text{Ag}$  [2]  
all species correct = 1    balancing = 1  
Sn to  $\text{Sn}^{2+}$  oxidation (can be written separately or as a correct half-equation) [1]
- (b) no reaction [1]  
 $\text{Mg}(\text{OH})_2 \rightarrow \text{MgO} + \text{H}_2\text{O}$     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)  $\text{H}_2$  on RHS [1]  
**ignore** any other species on RHS  
rest of equation fully correct i.e.  $2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$  [1]
- (ii)  $\text{H}^+$  removed / escapes / discharged / used up / reduced [1]  
(equilibrium) moves to RHS / more water molecules ionise or  
dissociate / forward reaction favoured [1]
- (iii) oxygen /  $\text{O}_2$  [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]

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- (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)  $\text{Mg} + 2\text{CH}_3\text{COOH} \rightarrow (\text{CH}_3\text{COO})_2\text{Mg} + \text{H}_2$  [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]  
 $\text{C}_4\text{H}_4\text{O}_4$  [1]  
 correct formula with no working scores both marks.
- (iv)  $\text{HOOCCH}=\text{CHCOOH}$  /  $\text{CH}_2=\text{C}(\text{COOH})_2$  [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 ( <b>not</b> 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]

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- (ii) (1) nitrogen has smaller  $M_r$  / lighter molecules / lower density [1]  
nitrogen **molecules** / **particles** move faster (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-biodegradable / 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 [3]
- (b) (i) propene / propylene [1]  
**accept** prop-1-ene  
**not** prop-2-ene  
 $\text{CH}_3\text{-CH=CH}_2$  [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)  $\text{H}_2\text{N(CH}_2)_6\text{NH}_2$  [1]  
 $\text{HOOC(CH}_2)_8\text{COOH}$

[Total: 15]