**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 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]**