**UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS**

**International General Certificate of Secondary Education**

# MARK SCHEME for the October/November 2011 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)** **(i)** Cs / Fr [1]

**(ii)** Br [1]

**(iii)** U / Pu / Th [1]

**(iv)** I or At [1]

**(v)** As [1]

**(vi)** He / Ne / Ar / Kr / Xe [1]

**(b)** **(i)** $GeO_2$ / GeO [1]

**(ii)** $TeBr_2$ / $TeBr_4$ [1]

**(c)** **(i)** $Sr^{2+}$ [1]

**(ii)** $F^-$ [1]

**2** **(a)** **(i)** molecule / unit / simple compound / building block **and** used to make a polymer / big molecule / long chain / macromolecule [1]

formation of a polymer / big molecule / long chain / macromolecule **or** joining of monomers **and** elimination / removal / formation of a simple or small molecule / $H_2O$ / HC*l* [1]
**note:** two points needed for 1 mark in both parts

**(ii)** -O- linkage [1]
three correct monomer units [1]
continuation [1]

**(b)** **(i)** catalyst **and** from living organism [1]
**accept:** biological catalyst / protein catalyst

**(ii)** enzyme denatured / destroyed [1]

**(iii)** chromatography [1]
locating agent / description of locating agent [1]
measure $R_f$ / compare with standards [1]

**3** **(a)** sodium hydroxide solution [1]
warm [1]
(only) ammonium phosphate gives off ammonia / gas (which will turn red litmus paper blue) [1]
**or:**
sodium hydroxide solution [1]
dissolve fertiliser in water [1]
$Ca^{2+}$ gives (white) ppt [1]
**or:**
flame test [1]
$Ca^{2+}$ brick red / orange / orange-red [1]
$NH_4^+$ no colour [1]

**(b)** iron catalyst [1]
pressure 150–300 atmospheres [1]
temperature 370–470 °C [1]
$N_2 + 3H_2 \rightleftharpoons 2NH_3$ [1]
**note:** units required for temperature and pressure

**(c)** potassium / K [1]

**(d)** **(i)** needs to be soluble / in solution (to be absorbed by plants) [1]

**(ii)** base [1]
proton acceptor [1]

**(e)** plant growth depends on soil acidity or pH / plants have optimum pH (for growth) [1]

add $Ca(OH)_2$ / CaO / $CaCO_3$ / lime / slaked lime / quicklime / limestone [1]

**4** **(a)** **(i)** alloy / mixture [1]
iron and carbon / another metal or element etc. [1]

**(ii)** electron loss [1]

**(b)** electrons move from / lost from Mg [1]
to steel / iron [1]

**(c)** **(i)** $2H^+ + 2e \rightarrow H_2$ [2]
not balanced = 1

**(ii)** sacrificial protection – is a cell [1]
cathodic protection – is electrolysis NOT electrical cell [1]
**or:**
sacrificial protection – electrons from more reactive metal [1]
cathodic protection – electrons from battery etc. [1]
**or:**
sacrificial protection – does not need or use power / battery / electricity / electrical cell [1]
cathodic protection – does [1]
**or:**
sacrificial protection uses up / needs a sacrificial / more reactive metal [1]
cathodic protection doesn't [1]

**5** **(a)** light / UV / sun / sunlight / solar energy [1]
starts / initiates / speeds up [1]

**(b)** **(i)** 0.03 % – 1(%) carbon dioxide [1]
**accept:** less than 1(%)
20 % – 21(%) oxygen [1]

**(ii)** remove carbon dioxide from atmosphere [1]
produce oxygen [1]
any **two** from:
photosynthesis
chlorophyll / chloroplast
light / sun / sunlight / UV / photochemical
formed carbohydrates / glucose / sugar(s) [2]

**(c)** reaction is photochemical / needs light [1]
(light) causes formation of silver / silver ions reduced [1]
(on formation of silver) goes black [1]
no light still silver(I) bromide / stays white / no reaction [1]

**6** **(a)** any **three** from:
barium more reactive / forms ions more readily
barium reacts with (cold) water, nickel does not
barium more vigorous with acids
nickel compounds coloured, barium compounds white
nickel has more than one oxidation state, barium has one
nickel / nickel compounds catalysts, barium / barium compounds not catalysts
nickel forms complex ions, barium does not [3]

**(b)** **(i)** forward reaction favoured by low temperatures / reverse reaction favoured by high temperatures / heat [1]
exothermic [1]

**(ii)** products / RHS [1]
has fewer moles / molecules / smaller volume / ORA [1]

**(iii)** do not react or left behind / left at 60 °C [1]

**(iv)** electrolysis [1]
cathode (pure) nickel [1]
anode impure nickel [1]
electrolyte is a soluble nickel salt [1]

**7** **(a)** correct method shown
i.e. 126/14 (= 9) **or** 14x = 126 **or** x = 9 **or** (12 × 9) + 18 = 126 [1]
$C_9H_{18}$
**note:** correct formula only = 1 [1]

**(b)** **(i)** all hydrogen atoms 1bp [1]
C—C bond atoms 1bp [1]
C=C 2 bp [1]

**(ii)** correct repeat unit [1]
continuation [1]

**(iii)** bonds broken
H-H +436 (kJ/mol) C=C +610 = +1046 (kJ/mol) [1]
bonds formed
2C-H –415 × 2 kJ/mol C-C –346 = –1176 (kJ/mol) [1]
–130 kJ/mol / more energy released than absorbed [1]
**or:**
bonds broken
3882 (kJ/mol) [1]
bonds formed
4012 (kJ/mol) [1]
–130 kJ/mol / more energy released than absorbed [1]
**allow:** ecf for final mark as long as the answer is not positive
**note:** units not necessary

**(c)** **(i)** butan-1-ol or butan-2-ol or butanol [1]

**(ii)** $CH_3$-$CH_2$-CH(Br)-$CH_2$Br [2]
$C_4H_8Br_2$ = 1
**note:** any other dibromobutane = 0

**(iii)** HI [1]