CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2013 series

0620 CHEMISTRY

0620/32 Paper 3 (Extended Theory), maximum raw mark 80

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1 (a) (i) named noble gas [1]
accept: any noble gas
accept: symbol

(ii) H_2O / CO_2 [1]
not: names **not:** equations

(b) (i) oxygen and nitrogen (in air) (react) [1]
at high temperature [1]
accept: in engines / lightning **not:** in exhausts

(ii) fossil fuels / fuels which contain sulfur [1]
accept: named fossil fuel such as coal / oil / natural gas
burn / combust [1]

(iii) any two from:
damage buildings / soil acidification / leaching from soil / soil nutrients become unavailable / kill microbes / acidify lakes / kill fish / damage trees / reduction in plant growth / crop loss [2]

(c) (i) <u>oxygen</u> reacts with copper [1]
to form copper oxide (which is black) [1]

(ii) measure volume at room temperature / gas has different volumes at different temperatures / volume of gas depends on temperature / hot gas has higher volume / heat causes expansion (of gases) / ORA [1]

(iii) no oxygen left **or** <u>all</u> the oxygen has reacted (with copper) [1]

(iv) 39–40 cm^3 **note:** units required [1]

2 (a) B $^{39}_{19}K$ [1]
positive charge + [1]

C $^{65}_{30}Zn$ [1]

D $^{16}_{8}O$ [1]
charge 2– [1]

E $^{70}_{31}Ga$ [1]

(b) number of p = number of e [1]

number of p > number of e [1]

number of p < number of e [1]

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3 (a) (i) complete combustion / combustion in excess oxygen [1]

of fuels containing carbon / fossil fuels / hydrocarbon (fuels) [1]

produce carbon dioxide / increase percentage of CO_2 in atmosphere [1]

(ii) living things / cells / plants / animals / humans / micro-organisms [1]
(oxidise / react with) oxygen **and** food / foodstuff / named foodstuff / carbohydrate / sugar / glucose [1]

produces carbon dioxide [1]

(b) (i) glucose **or** starch **or** carbohydrate [1]

oxygen [1]

(ii) light / sunlight / sun / UV [1]

chlorophyll **accept:** chloroplast [1]

4 (a) (i) **first reaction**
volume / moles / molecules of reactants and products are different [1]

second reaction
volume / moles / molecules of reactants and products are the same [1]

(ii) first reaction (forward) reaction is endothermic [1]
second reaction (forward) reaction is exothermic [1]

(b) (i) $C_8H_{18} \rightarrow 2C_4H_8 + H_2$ [1]

(ii) $2H^+ + 2e \rightarrow H_2$ [2]

or $2H_3O^+ + 2e \rightarrow H_2 + 2H_2O$
accept: –2e on right hand side accept: e^-
note: not balanced = 1

(iii) chlorine / Cl_2 / [1]
cond: water treatment / solvents / plastics / PVC / bleach / disinfectants / HCl / kill bacteria / sterilising water / chlorination of water / swimming pools / pesticides / herbicides / insecticides / germicides / pharmaceuticals [1]

sodium hydroxide/NaOH [1]

cond: making soap / degreasing / making paper / detergents / bio-diesel / paint stripper / clearing drains / alumina from bauxite / oven cleaner / bleach [1]

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5 **(a)** **(i)** does not decay **or** non-biodegradable **or** flexible **or** bendable **or** easily moulded **or** low density / light / lightweight **or** waterproof / insoluble in water **or** does not corrode **or** durable [1]

(ii) any two from: [2]
chlorine
hydrogen chloride
carbon monoxide

(b) **(i)** $CH_3—CH = CH_2$ [1]
note: can be fully or semi-displayed, C = C must be shown

(ii) correct repeat unit [1]
$–CH(C_6H_5)–CH_2–$

continuation shown [1]

(c) glucose two products (polymer and water) / condensation (polymerisation) / (small) molecules removed [1]

phenylethene one product (polymer) / addition (polymerisation) [1]

6 **(a)** **(i)** ions cannot move / no free ions in solid state [1]
ions can move / free ions in liquid state [1]
note: ions can only move in liquid state = 2

(ii) reduce melting point / reduce energy costs / better conductor when dissolved in cryolite [1]

(iii) burns in oxygen / reacts with oxygen / oxidised by oxygen / forms carbon dioxide / forms carbon monoxide [1]

(iv) high melting point / inert / unreactive [1]

(b) protective / unreactive / resists / prevents corrosion / non-porous (layer) [1]

of (aluminium) oxide [1]

(c) **(i)** good conductor (of electricity) [1]
low density / light / lightweight [1]

(ii) steel core (increased) strength / prevent sagging / to increase separation of pylons / support [1]

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7 **(a)** **(i)** $CH_3COOCH_2CH_3$ / $CH_3CO_2CH_2CH_3$ / $CH_3COOC_2H_5$ / $CH_3CO_2C_2H_5$ / $C_2H_5OOCCH_3$ / $CH_3CH_2OOCCH_3$ **not:** –OCO– linkage [1]
note: formulae can be displayed or semi-displayed
note: penalise sticks (i.e. any missing atoms)

(ii) butyl methanoate [1]

(b) **(i)** fats / <u>vegetable</u> oils / triglycerides / lipids [1]

(ii) two correct ester linkages, e.g. –OOC / $–O_2C$ and –COO / $–CO_2$ [1]

contents of the 'boxes' being C_6H_4 and C_2H_4 or CH_2CH_2 [1]
continuation bonds at **both** ends [1]

(c) **(i)** to make colourless / invisible (spots) [1]
visible / coloured / seen / position made clear / indicate [1]

(ii) $\frac{\text{distance travelled by sample}}{\text{distance travelled by solvent (front)}} = R_f$ [1]

(iii) sample 1 R_f = 0.20 to 0.24 tartaric (acid) [1]
sample 2 R_f = 0.44 to 0.48 malic (acid) [1]

8 **(a)** **(i)** (the number of particles which is equal to the number of atoms in) 12 g of carbon 12
or
the mass <u>in grams</u> which contains the Avogadro's constant number of particles
or
Avogadro's constant **or** 6 to 6.023×10^{23} <u>of atoms / ions / molecules / electrons / particles</u>
or
(the amount of substance which has a mass equal to) its relative formula mass / relative atomic mass / relative molecular mass <u>in grams</u>
or
(the amount of substance which has a volume equal to) 24 dm^3 of a <u>gas</u> at RTP
[1]

(ii) (Avogadro's constant is the) number of particles / atoms / ions / molecules in one mole of a substance
or
the <u>number</u> of carbon atoms in 12 g of C(12).
or
the number of particles / molecules in 24 dm^3 of a <u>gas</u> at RTP
or
6 to 6.023×10^{23} (particles / atoms / ions / molecules / electrons) [1]

(b) CH_4 **and** SO_2 [1]

2/16 = 1/8 or 0.125 moles of CH_4 **AND** 8/64 = 1/8 or 0.125 moles of SO_2 [1]

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(c) (i) 4.8/40 = 0.12 moles of Ca
3.6/18 = 0.2 moles of H_2O **both** correct [1]

(ii) Ca is in excess (**no mark**) (because 0.12 moles of Ca need) 0.24 moles / 4.32 g of H_2O to react [1]
there is not enough / there are 0.2 moles / 3.6 g of H_2O [1]
or
Ca is in excess **(no mark)** (because 0.2 moles / 3.6 g of water will react with) 0.1moles/4.0 g of Ca [1]
there is more than that / there are 0.12 moles / 4.8 g of Ca [1]
or
Ca is in excess **(no mark)** because the mole ratio Ca:H_2O is 3:5 / mass ratio 4:3 [1]
which is <u>bigger than</u> the required mole ratio of 1:2 / mass ratio 10:9 [1]
or
Ca is in excess **(no mark)** because the mole ratio H_2O:Ca is 5:3 / mass ratio 3:4 [1]
which is <u>smaller than</u> the required mole ratio of 2:1 / mass ratio 9:10 [1]

(iii) $0.02 \times 40 = 0.8$ (g) [1]

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