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CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the October/November 2013 series

0620 CHEMISTRY

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

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1 **(a)** C **and** F

(b) A [1]

(c) B [1]

(d) D [1]

(e) E [1]

(f) A **and** D [1]

[Total: 6]

2 **(a)** **(i)** two atoms per molecule [1]

(ii) 7e in outer shell or level / same number of outer electrons / need to gain one electron [1]

(iii) different number of energy levels / different number of electrons [1]

(iv)

halogen	solid, liquid or gas at room temperature	colour
chlorine	gas	yellow / yellow green / green
bromine	liquid	brown / red-brown / orange-brown not: red / orange
iodine	solid	black / grey / silver-grey / purple / violet **NOT**: blue-black

NOTE: one mark for each vertical column [2]

(b) correct formula, AsF_3 [1]
3nbps and 1bp around all 3 fluorine atoms [1]
3bps and 1nbp around arsenic atom [1]

(c) (increased) light increases / causes forward reaction / light causes AgC*l* reacts with CuC*l* [1]
(increased) light increases the amount of silver (and so darkens glass) [1]
decrease in light reverses reaction / uses up silver / silver reacts (and so reduces darkness)[1]

[Total: 11]

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3 (a) (i) the (forward) reaction is endothermic

(ii) none
volume of reactants and products the same [
ACCEPT: number of moles or molecules

(iii) the reaction (between oxygen and nitric oxide) is <u>exothermic</u> [1]
high temperatures push equilibrium to left / high temperatures decrease yield of products / low temperatures favour forward reaction [1]

(iv) $4NO_2 + O_2 + 2H_2O \rightarrow 4HNO_3$ [2]
not balanced = (1) only

(v) (cost of) high amount of electricity / energy [1]

(b) (i) contains more nitrogen [1]

(ii) photosynthesis [1]
chlorophyll is catalyst / chlorophyll absorbs light [1]
carbon dioxide and water react [1]
to make glucose / carbohydrates / starch / sugar / named sugar [1]

[Total: 13]

4 (a) Any one of:
$Fe_2O_3 + 3C \rightarrow 2Fe + 3CO$
$2Fe_2O_3 + 3C \rightarrow 4Fe + 3CO_2$
$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$
for correct equation (2)
not balanced = (1) only

any four of:

coke burns to form carbon dioxide / $C + O_2 \rightarrow CO_2$

this reacts with more carbon to form carbon monoxide / $C + CO_2 \rightarrow 2CO$

calcium carbonate decomposes to form calcium oxide and carbon dioxide / $CaCO_3 \rightarrow CaO + CO_2$

calcium oxide / calcium carbonate reacts with silica / silicon oxide / silicon(IV) oxide (in ore) to form calcium silicate / slag / $CaO + SiO_2 \rightarrow CaSiO_3$ **or** $CaCO_3 + SiO_2 \rightarrow CaSiO_3 + CO_2$

the reaction between carbon and oxygen is exothermic / produces heat / coke is used as a fuel / the slag floats on the (molten) iron / the slag and molten iron can be run off separately [6]

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(b) (i) greenhouse effect / CO_2 is a greenhouse gas
global warming / ice caps melting / suitable example

(ii) burning or combustion of charcoal produces carbon dioxide [
trees use carbon dioxide (in photosynthesis) [1]

(iii) cathode reaction $Fe^{3+} + 3e \rightarrow Fe$ [1]

anode reaction $2O^{2-} \rightarrow O_2 + 4e$ [2]
not balanced = (1) only

[Total: 13]

5 (a) because they have more than one oxidation state or valency / form ions with different charges [1]

there are two iron oxides (iron(III) oxide and iron(II) oxide) / iron forms Fe^{2+} and Fe^{3+} compounds / iron forms iron(II) and iron(III) compounds [1]

(b) (i) to remove the precipitate / remove the silver(I) chromate(VI) / remove the residue [1]

(ii) to remove <u>soluble</u> impurities / remove named <u>soluble</u> salt e.g. potassium nitrate / remove reactants [1]

(iii) to dry solid / to remove water [1]

(c) (i) need <u>one</u> mole of potassium chromate(VI) for <u>two</u> moles of silver(I) nitrate / correct references to mole ratio [1]

(ii) mass of $AgNO_3$ needed is $170 \times 0.2 \times 0.1 = 3.4$g [2]
NOTE: if answer given is 34 they have omitted 0.1
ALLOW: (1) ecf

(iii) number of moles of $AgNO_3$ used = $0.02 \times 0.2 = 0.004$ [1]

number of moles of Ag_2CrO_4 formed = 0.002 [1]

mass of one mole of Ag_2CrO_4 = 332g

mass of Ag_2CrO_4 formed = 0.664g [1]
NOTE: use ecf when appropriate

[Total: 11]

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6 **(a)** **(i)** $Cu(OH)_2 \rightarrow CuO + H_2O$

(ii) Rb

(b) **(i)** electron loss [1]

(ii) because they can accept electrons [1]

(c) **(i)** copper and mercury [1]

(ii) add copper / mercury / metal to (named) acid **and** no reaction / no bubbles / no hydrogen [1]

(d) **(i)** Mn [1]

(ii) (solution) becomes colourless / decolourises
NOT: clear [1]

[Total: 8]

7 **(a)** **(i)** contains only carbon, hydrogen and oxygen [1]
hydrogen (atom) to oxygen (atom) ratio is 2:1 [1]
ALLOW: C:H:O as 1:2:1 or $C_n(H_2O)_n$

(ii) condensation [1]
polymerisation [1]

(b) **(i)** cells / micro-organisms / plants / animals / metabolic reactions [1]
obtaining energy from food / glucose / nutrients [1]

(ii) $2C_2H_5OH + 2CO_2$ [2]
allow: C_2H_6O for C_2H_5OH
not balanced = (1) only

(iii) to prevent aerobic respiration / to get anaerobic respiration / to prevent ethanoic acid / lactic acid / carboxylic acids being formed / to prevent oxidation of ethanol [1]

(c) displayed formula of methyl butanoate [2]
NOTE: all bonds must be shown
NOTE: award (1) if error in alkyl groups but correct displayed structure of –COO–

(d) **(i)** alcohol, e.g. glycerol, circled [1]
ALLOW: if only part of glycerol molecule is circled as long as it involves an OH group

(ii) saturated
correct reason based on group $C_{17}H_{35}$ / all C–C bonds / no C = C bonds [1]

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(iii) salt / carboxylate / alkanoate
(making) soap
ACCEPT: detergent / washing

(e) at least one correct amide linkage –CONH– [1]
continuation shown at both ends of chain [1]
diagram showing three (different) amino acid residues [1]

[Total: 18]

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