CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the October/November 2013 series

0620 CHEMISTRY

0620/31 Paper 3 (Extended Theory), maximum raw mark 80

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CAMBRIDGE
International Examinations

1 **(a)** uranium / plutonium / thorium [1]

(b) graphite / carbon [1]

(c) platinum / titanium / mercury / gold [1]
NOT: carbon / graphite

(d) helium [1]

(e) nitrogen / phosphorus [1]

(f) argon [1]
ACCEPT: any ion 2 + 8 + 8 e.g. K^+ etc.

(g) tellurium [1]
ACCEPT: correct symbol

[Total: 7]

2 **(a)** Any three of:
iron is harder
iron has higher density
ACCEPT: heavier **or** potassium lighter
iron has higher mp **or** bp
iron has higher tensile strength **or** stronger
iron has magnetic properties [3]
NOTE: has to be comparison, e.g. iron is hard (0) but iron is harder (1)
NOT: appearance e.g. shiny
ACCEPT: comparative statements relating to potassium

(b) potassium hydrogen (1) and potassium hydroxide (1)
zinc hydrogen (1) and zinc oxide (1)
copper no reaction (1) [5]

[Total: 8]

3 (a) (i) fractional distillation [1]
(liquid) air [1]

(ii) cracking / heat in presence of catalyst [1]
of alkane / petroleum [1]
to give an alkene and hydrogen [1]

OR: electrolysis (1)
named electrolyte (1)
hydrogen at cathode (1)

OR: from methane (1)
react water / steam (1)
heat catalyst (1)
only **ACCEPT:** water with methane **or** electrolysis

(b) (i) the pair with both graphs correct is C [1]
NOTE: mark **(b)(ii)** independent of **(b)(i)**

(ii) high pressure favours side with lower volume / fewer moles [1]
this is RHS / product / ammonia [1]
$\%NH_3$ / yield increases as pressure increases [1]

the forward reaction is exothermic [1]
exothermic reactions favoured by low temperatures [1]
$\%NH_3$ / yield decreases as temperature increases [1]
ACCEPT: reverse arguments

(iii) increases reaction rate [1]
ACCEPT: reduces activation energy [1]
OR: decreases the amount of energy particles need to react
OR: economic rate at lower temperature so higher yield

[Total: 14]

4 (a) (i) (mass at t =0) – (mass at t = 5) [1]
NOTE: must have mass at t = 5 not final mass

(ii) fastest at origin
slowing down between origin and flat section gradient = 0
where gradrient = 0
three of above in approximately the correct positions [2]

(iii) 3 correct comments about gradient = [2]
2 correct comments about gradient = [1]
1 correct comment about gradient = [0] [2]

(b) start at origin and smaller gradient [1]
same final mass just approximate rather than exact [1]

(c) (i) smaller surface area [1]
lower collision rate [1]

(ii) molecules have more energy [1]
collide more frequently / more molecules have enough energy to react [1]

(d) number of moles of HCl in 40 cm^3 of hydrochloric acid,
concentration 2.0 mol / dm^3 = 0.04 × 2.0 = 0.08 [1]
maximum number of moles of CO_2 formed = 0.04 [1]
mass of one mole of CO_2 = 44 g [1]
maximum mass of CO_2 lost = 0.04 × 44 = 1.76 g [1]

[Total: 15]

5 (a) (i) have same molecular formula / both are C_5H_{12} [1]
they have different structural formulae / different structures [1]

(ii) CH_3-CH_2-CH=CH-CH_3 / any other correct isomer [1]

(b) (i) CH_2-(Br)-CH_2Br [1]
NOT: $C_2H_4Br_2$
dibromoethane [1]
NOTE: numbers not required but if given must be 1, 2

(ii) CH_3-CH_2-CH_3 [1]
NOT: C_3H_8
propane [1]

(iii) CH_3-CH_2-CH_2-CH_2-OH / CH_3-CH_2-CH(OH)-CH_3 [1]
butanol [1]
numbers not required but if given must be correct and match formula

(c) (i) CH_3-CH=CH-CH_2-CH_3 [1]
CH_3-CH=CH-CH_3 [1]

(ii) pink / purple [1]
colourless [1]
NOT: clear

(d) -CH_2-CH(CN)-CH_2-CH(CN)-
correct repeat unit CH_2-CH(CN) [1]
COND: at least 2 units in diagram [1]
continuation [1]

[Total:16]

6 **(a)** **(i)** (attractive force between) positive ions [1]
and (negative) electrons [1]
opposite charges attract ONLY [1]
electrostatic attraction ONLY [1]

(ii) lattice / rows / layers of lead ions / cations / positive ions [1]
NOT: atoms / protons / nuclei
can slide past each other / the bonds are non-directional [1]

(b) **(i)** anhydrous cobalt chloride becomes hydrated [1]
ACCEPT: hydrous

(ii) carbon dioxide is acidic [1]
sodium hydroxide and calcium oxide are bases / alkalis [1]

(iii) Any two of:
water, calcium carbonate and sodium carbonate [2]
ACCEPT: sodium bicarbonate

(c) number of moles of CO_2 formed = 2.112 / 44 = 0.048 [1]
number of moles of H_2O formed = 0.432 / 18 = 0.024 [1]

x = 2 and y = 1 **NOT:** ecf from this line

formula is $2PbCO_3.Pb(OH)_2$ / $Pb(OH)_2.\ 2PbCO_3$ [1]

[Total:12]

7 **(a)** **(i)** hydrogen (atoms) replaced by (atoms) of a different element e.g. chlorine [1]
NOT: substitute

(ii) light required [1]

(b) exothermic reaction gives out energy [1]
endothermic reaction absorbs
takes in energy [1]

(c)

bonds broken	energy
C-H	+412
C*l*-C*l*	+242
total energy	+654

[1]

bonds formed	energy
C-C*l*	–338
H-C*l*	–431
total energy	–769

[1]
energy change –115 [1]
negative sign indicates exothermic [1]

[Total: 8]