

MARK SCHEME for the October/November 2013 series

0439 CHEMISTRY (US)

0439/31

Paper 3 (Extended Theory), maximum raw mark 80

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Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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- 1 (a) uranium / plutonium / thorium
- (b) graphite / carbon
- (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]**

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- 3 (a) (i) fractional distillation (liquid) air
- (ii) cracking / heat in presence of catalyst of alkane / petroleum to give an alkene and hydrogen [1]
[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]
%NH₃ / yield increases as pressure increases [1]
- the forward reaction is exothermic [1]
exothermic reactions favoured by low temperatures [1]
%NH₃ / 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 gradient = 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]

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- (c) (i) smaller surface area
lower collision rate
- (ii) molecules have more energy
collide more frequently / more molecules have enough energy to react [1]
- (d) number of moles of HCl in 40 cm³ of hydrochloric acid, [1]
concentration 2.0 mol / dm³ = 0.04 × 2.0 = 0.08 [1]
maximum number of moles of CO₂ formed = 0.04 [1]
mass of one mole of CO₂ = 44 g [1]
maximum mass of CO₂ lost = 0.04 × 44 = 1.76 g [1]

[Total: 15]

- 5 (a) (i) have same molecular formula / both are C₅H₁₂ [1]
they have different structural formulae / different structures [1]
- (ii) CH₃-CH₂-CH=CH-CH₃ / any other correct isomer [1]
- (b) (i) CH₂-(Br)-CH₂Br [1]
NOT: C₂H₄Br₂
dibromoethane [1]
NOTE: numbers not required but if given must be 1, 2
- (ii) CH₃-CH₂-CH₃ [1]
NOT: C₃H₈
propane [1]
- (iii) CH₃-CH₂-CH₂-CH₂-OH / CH₃-CH₂-CH(OH)-CH₃ [1]
butanol [1]
numbers not required but if given must be correct and match formula
- (c) (i) CH₃-CH=CH-CH₂-CH₃ [1]
CH₃-CH=CH-CH₃ [1]
- (ii) pink / purple [1]
colourless [1]
NOT: clear
- (d) -CH₂-CH(CN)-CH₂-CH(CN)- [1]
correct repeat unit CH₂-CH(CN) [1]
COND: at least 2 units in diagram [1]
continuation [1]

[Total:16]

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- 6 (a) (i) (attractive force between) positive ions and (negative) electrons
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 CO₂ formed = 2.112 / 44 = 0.048 [1]
number of moles of H₂O formed = 0.432 / 18 = 0.024 [1]
- x = 2 and y = 1 **NOT:** ecf from this line
- formula is 2PbCO₃.Pb(OH)₂ / Pb(OH)₂. 2PbCO₃ [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-Cl +242
total energy +654 [1]
- bonds formed energy
C-Cl -338
H-Cl -431
total energy -769 [1]
energy change -115 [1]
negative sign indicates exothermic [1]

[Total: 8]