

2813/01

Mark Scheme

June 2005

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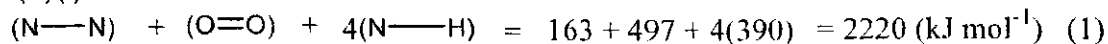
How FAR? How FAST?



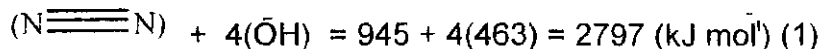
- 2(a) when the conditions on a system in equilibrium are changed (1)  
 the equilibrium moves to minimise the effects of the change/  
 counteract/ resist/ oppose the change(1) [2]
- (b)(i) becomes brown/ darker/ colour more intense (1)  
 moves towards LHS/ towards  $\text{NO}_2$  (1)  
 forward reaction is exothermic/ reverse reaction is endothermic (1)[3]
- (ii) becomes less brown/ pale/ colourless (1)  
 moves towards RHS/ towards  $\text{N}_2\text{O}_4$  (1)  
 fewer moles on RHS (1) [3]
- (c)(i) because nitrogen starts as  $\text{NO}_2$  in oxidation number +4 (1)  
 and forms ( $\text{HNO}_3$ ) oxidation state +5 and ( $\text{HNO}_2$ ) oxidation state +3 (1) [2]
- (ii) internal combustion engine/ vehicular transport/ lightning (1) [1]
- (d)(i)  $\text{H}^+$ / hydrogen (1) [1]
- (ii)  $2\text{H}^+ + \text{CaCO}_3 \rightarrow \text{Ca}^{2+} + \text{CO}_2 + \text{H}_2\text{O}$   
 $\text{CO}_3^{2-} + 2\text{H}^+ \rightarrow \text{H}_2\text{O} + \text{CO}_2$   
 formation of  $\text{CO}_2$  (1)  
 rest of equation (1) [2]
- (iii) stone crumbles/ decays/ corrode/ dissolve after reaction/  
 chemically eroded (1) [1]

[Total: 15]

1(a)(i) bonds broken



bonds made



broken  $\Delta H$  is +ve and made  $\Delta H$  is -ve (1)

enthalpy of reaction =  $-577 \text{ (kJ mol}^{-1}\text{)} \quad (1)$  [4]

(ii)  $\frac{577}{32} = 18.0 \text{ (kJ)} \quad (1)$  [1]

(b) N-N bond is weak/ higher  $E_a$  for ammonia/ rate too slow for ammonia/ too much energy to break bonds in ammonia / hydrazine is liquid/ do not need pressurised containers/ more moles/ lots of gas produced by hydrazine/ more energy per mole produced by hydrazine (1) [1]

(c)(i) as a base (1) ..... accepts a proton/ $\text{H}^+$ / **neutralises** an acid/ reacts with acid to form salt/ has a **lone** pair of electrons (1) [2]

(ii) fertiliser (1) [1]

(iii) manufacture of explosives/ dyes/ nitric acid/ fibres/ ammonium nitrate/ urea/ refrigeration/ cleaning agents/ fertiliser (if not allowed in (ii) (1) [1]

[Total: 10]

4(a) catalyst alters rate of reaction/ lowers  $E_a$  (1)

remains unchanged **after** the reaction/ is not changed at the **end** of the reaction BUT negated by  
does not take part in reaction (1) [2]

(b) homogeneous catalyst and reagents are in the same state (1)

heterogeneous catalyst and reagents in different states (1)

example of homogeneous eg  $H^+$  in esterification/  $Cl^-$  with ozone/ named enzyme (1)

example of heterogeneous eg iron in Haber process/ rhodium, platinum, palladium in catalytic converters/ pumice/ conc. sulphuric acid in dehydration of ethanol, zeolite/ aluminium oxide/ silicon dioxide in cracking (1)

equation for heterogeneous/ homogeneous catalysed reaction (1)

mode of action of heterogeneous catalyst - gases adsorbed/ bonds forming between reactants and catalyst (1)

bonds weakened allowing reaction to take place (1)

product gases desorbed/ description of desorption (1)

[7 max]

[Total: 9]

## Mark Scheme for Unit 2813/01, June 2005 - ERRATUM

See page 16 of the main booklet.

As part of the printing process, the font change has lost the correct symbol: ( $\Delta$ ) has become a square.

The page should read as follows:

3(a) (enthalpy change) when 1 mole of substance/ element/ compound (1)  
NOT energy needed

is completely burnt (1) [2]

(b)  $\text{C}_3\text{H}_7\text{OH}(\text{l}) + 4\frac{1}{2} \text{O}_2(\text{g}) \rightarrow 3\text{CO}_2(\text{g}) + 4\text{H}_2\text{O}(\text{l})$

correctly balanced equation (1)

state symbols (species must be correct) (1)

[2]

(c)(i)  $\Delta H = mc\Delta T$  (1)

$$\Delta H = 50 \times 4.18 \times 12.8 = 2675 \text{ (J)} = 2.68 \text{ (kJ)} \text{ (1)}$$

[2]

ignore sign

(ii) Mr propan-1-ol = 60 (1) (1)

number moles = 0.00167 (1)

[2]

(iii)  $\Delta H = \bar{\Delta}H_c^\ominus(1)$

[1]

(ii) heat losses (1)

thermal capacity of beaker ignored (1)

conditions were non-standard (1)

combustion could be incomplete (1)

propan-1-ol evaporates (1)

water evaporates (1)

[2max]

[Total: 11]