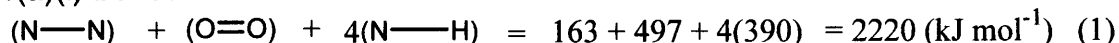
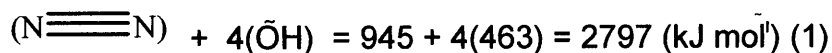


1(a)(i) bonds broken



bonds made



broken ΔH is +ve and made ΔH is -ve (1)

enthalpy of reaction = 577 (kJ mol⁻¹) (1) [4]

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

(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/ 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/ refrigerants/ cleaning agents/ fertiliser (if not allowed in (ii)) (1) [1]

[Total

- 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 NO₂ (1)
forward reaction is exothermic/ **reverse** reaction is endothermic (1)[3]
- (ii) becomes less brown/ pale/ colourless (1)
 moves towards RHS/ towards N₂O₄ (1)
 fewer moles on RHS (1) [3]
- (c)(i) because nitrogen starts as NO₂ in oxidation number +4 (1)
 and forms (HNO₃) oxidation state +5 and (HNO₂) oxidation state +3 (1) [2]
- (ii) internal combustion engine/ vehicular transport/ lightning (1) [1]
- (d)(i) 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 CO₂ (1)
 rest of equation (1) [2]
- (iii) stone crumbles/ decays/ corrode/ dissolve after reaction/
 chemically eroded (1) [1]

[Total: 15]

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: (Δ) 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)
- $\Delta H = 50 \times 4.18 \times 12.8 = 2675 \text{ (J)} = 2.68 \text{ (kJ)}$ (1) [2]
- ignore sign
- (ii) Mr propan-1-ol = 60 (1) (1)
- number moles = 0.00167 (1)
- [2]
- (iii) $\Delta H = -1608 \text{ (kJ mol}^{-1}\text{)}$ (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]

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]