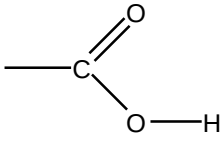
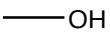
CAT 3 1995: **Sample Answers**

Question 1

a. Enzymes are specific to a particular reaction

b. i. Energy storage, thermal insulation

ii. Most of the chemical bonds in a fat molecule are non-polar hence the water molecules will not bond well with the fat molecules.

iii.  and 

c. Circle one C=C double bond

Question 2

a. q= 450 x 9.9 x 4.18 = 18622 J per 1.10g of methanol

n(methanol)= 1.10/32 = 0.03437 mol

heat of combustion = 18622/0.03437 = 540 kJ mol^{-1}

b. some possible answers include:

insulate the sides and top of the beaker
screen the burner to trap more of the energy
carry out the reaction in a bomb calorimeter

Question 3

Cellulose	F
Protein	B
Unsaturated fat	C and D
Starch	F
Saturated fat	C and G

Question 4

a. i. mass number
ii atomic number
iii 141 and 36

b. i. $1s^2 2s^2 2p^6 3s^2 3p^2$
ii. IV or 4 or 14

c. i. B
ii. B
iii. A
iv. C

d. $Na_2O(s) + H_2O(l) \rightarrow 2NaOH(aq)$

$Al_2O_3(s) + 6H^+(aq) \rightarrow 2Al^{3+}(aq) + 3H_2O(l)$

$Al_2O_3(s) + 2OH^-(aq) + 3H_2O(l) \rightarrow 2Al(OH)_4^-(aq)$

$SO_3(aq) + 2OH^-(aq) \rightarrow SO_4^{2-}(aq) + H_2O(l)$

Question 5

a. Electron bombardment of the metal atoms in the vapour

b. for 68.9: $\frac{25}{25+17} \text{x} 100 = 59.5\%$ for 70.9: $\frac{17}{25+17} \text{x} 100 = 40.5\%$

c. Note the error in the question. The question should read relative <u>atomic</u> mass.

$$A_r = \frac{68.9 \text{x} 59.5 + 70.9 \text{x} 40.5}{100} = 69.7$$

Question 6

a. $HCO_3^-(aq) + H^+(aq) \rightarrow H_2CO_3(aq)$

b. The sequence of the amino acids in the protein

c. The formation of helices or sheets held together by hydrogen bonding.

d. The reactant is held in a fixed orientation. In this position the reaction may occur more readily

e. The tertiary structure of the protein has broken down to the extent that the reaction site is no longer present.

Question 7

a. i. Box A: H_2
Box B: LiOH or NaOH or KOH
Box C: O_2

ii. Electrons flow from negative electrode to positive electrode

b. $2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$

c. Conductors of electrons in and out of the cell
Catalyst for the electrode reactions
Porous to allow the gases to penetrate
Chemically inert in the cell

Question 8

a. -80 $kJmol^{-1}$

b. 25 $kJmol^{-1}$

c. 80 $kJmol^{-1}$

d. 105 $kJmol^{-1}$

e. the reactants and products are at the same energy levels but the activation energy should be lower