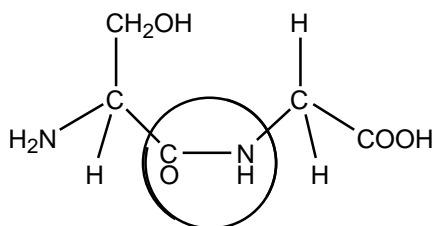
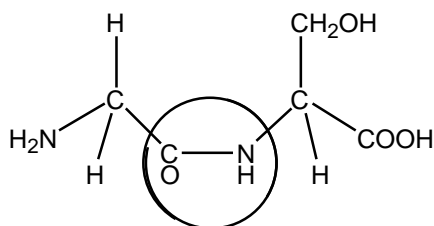


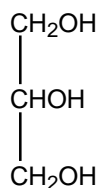
**CAT 3 1993:****Sample Answers**

1.
  - a. 5 minutes
  - b. reaction is enzyme catalysed  
the enzyme has partly denatured (broken down) at the higher temperature
  - c. hydrolysis
  - d. glucose
  - e. most of the carbohydrate in the cake is starch and sugar which can be digested and metabolised by humans. The carrot contains a larger proportion of cellulose which cannot be digested by humans.
  
2.
  - a.  $T = 31.003 - 29.350 = 1.653\text{K}$       calibration factor =  $12500/1.653 = 7562\text{ JK}^{-1}$
  
  - b.  $T = 29.350 - 24.755 = 4.575\text{K}$        $H = 4.575 \times 7562 = 34596\text{ J}$   
heat of combustion of bread sample =  $34596/3.30 = 10483\text{ Jg}^{-1} = 10.5\text{ kJg}^{-1}$
  - c. Weigh the sample, place in the oven, reweigh. If the weight is the same, the sample is dry.
  - d. Heat of combustion will be lower than the actual value. The actual mass of bread burnt is less than 3.30g because of the presence of water.
  
3.
  - a.  $1s^2 2s^2 2p^2$
  - b.  $1s^2 2s^2 2p^1 3s^1$
  - c. Electronically excited atoms emit light energy as the excited electrons drop down to a lower energy state. The energy of the light is exactly equal to the energy difference between the two electron energy levels. Each line represents the transition of electrons between two particular levels
  - d. Yes. Both these carbon atoms have the same number of protons and electrons and the same set of electronic energy levels. Hence the spectra will be the same.
  
4.
  - a.  $\text{Cu}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Cu}(\text{s})$
  
  - b.  $2\text{H}_2\text{O}(\text{l}) \rightarrow \text{O}_2(\text{g}) + 4\text{H}^+(\text{aq}) + 4\text{e}^-$
  
  - c. (i)  $2\text{H}_2\text{O}(\text{l}) + 2\text{e}^- \rightarrow \text{H}_2(\text{g}) + 2\text{OH}^-(\text{aq})$   
(ii) copper and nickel
  
5.
  - a. To complete the electrical circuit by allowing the flow of ions between the two half-cells.
  - b. A-ve, B +ve
  - c.  $\text{Fe}^{3+}(\text{aq}) + \text{e}^- \rightarrow \text{Fe}^{2+}(\text{aq})$   
 $\text{Zn}(\text{s}) \rightarrow \text{Zn}^{2+}(\text{aq}) + 2\text{e}^-$
  - d.  $2\text{Fe}^{3+}(\text{aq}) + \text{Zn}(\text{s}) \rightarrow 2\text{Fe}^{2+}(\text{aq}) + \text{Zn}^{2+}(\text{aq})$
  
6.
  - a. 0
  - b.  $\text{NH}_4^+$  -3
  - c. atmospheric  $\text{N}_2$     fixing step(via nitrogen fixing bacteria, Haber process, lightning)  
uptake by plants from the soil and incorporation into plant protein    consumption of plant or an animal which has eaten the plant by a human    digestion of the protein and re-assembly by the human into human protein

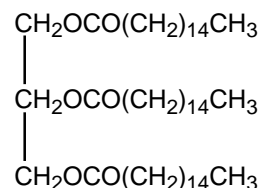
7. a. Circle both COOH groups  
b.



- 8 a. Glycerol



- b.



- 9 a.  $2\text{C}_4\text{H}_{10}(\text{g}) + 13\text{O}_2(\text{g}) \rightarrow 8\text{CO}_2(\text{g}) + 10\text{H}_2\text{O}(\text{l})$

b.  $M_r(\text{C}_4\text{H}_{10}) = 58.02 \quad n(\text{C}_4\text{H}_{10}) = 1/58.02$

heat released by burning 1.00g butane =  $2886/58.02 = 49800 \text{ J g}^{-1} = 49.8 \text{ kJ g}^{-1}$

c. energy required =  $(100-15) \times 4.2 \times 850 = 303450 \text{ J}$

mass of butane required =  $303450/49800 = 6.09 \text{ g of butane}$

d. danger of fire, dangerous levels of CO<sub>2</sub> or CO in the tent

- 10 a. (i) C (ii) D (iii) B (iv) B

b. See text book for examples

- 11 a. (i) Mg - strong metallic bonding between Mg atoms

Cl<sub>2</sub> - strong Cl-Cl covalent bond, weak dispersion forces between the Cl<sub>2</sub> molecules

(ii) Mg- all atoms are bonded strongly so it is difficult to separate the Mg atoms

Cl<sub>2</sub> - the bonding between the Cl<sub>2</sub> molecules is weak so it requires less energy to separate the molecules from each other

b. The size of the atoms is related to the core charge. When comparing atoms filling the same number valence shell, the greater the core-charge, the smaller the atom. Mg has a core charge of +2 whilst chlorine has a core charge of +7.

c. Suitable oxides include SO<sub>2</sub>, SO<sub>3</sub>, P<sub>2</sub>O<sub>3</sub>, P<sub>2</sub>O<sub>5</sub>, Cl<sub>2</sub>O<sub>7</sub>

