2019 VCE Chemistry Trial Examination Detailed Answers

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Answer Summary for Multiple-Choice Questions
2019 Kilbaha VCE Chemistry Trial Examination

Q1	A	Q16	B
Q2	A	Q17	C
Q3	D	Q18	B
Q4	D	Q19	C
Q5	D	Q20	A
Q6	D	Q21	C
Q7	C	Q22	A
Q8	C	Q23	B
Q9	B	Q24	D
Q10	A	Q25	B
Q11	D	Q26	D
Q12	B	Q27	A
Q13	C	Q28	B
Q14	B	Q29	B
Q15	C	Q30	A

ONE ANSWER PER LINE **ONE ANSWER PER LINE**

1.		B	C	D	16.	A		C	D
2.		B	C	D	17.	A	B		D
3.	A	B	C		18.	A		C	D
4.	A	B	C		19.	A	B		D
5.	A	B	C		20.		B	C	D
6.	A	B	C		21.	A	B		D
7.	A	B		D	22.		B	C	D
8.	A	B		D	23.	A	B		D
9.	A		C	D	24.	A	B	C	
10.		B	C	D	25.	A		C	D
11.	A	B	C		26.	A	B	C	
12.	A		C	D	27.		B	C	D
13.	A	B		D	28.	A		C	D
14.	A		C	D	29.	A		C	D
15.	A	B		D	30.		B	C	D

Answer distribution:	A	B	C	D
	7	8	8	7

Question 1 ANS A

The complete combustion of 45kg of octane can be calculated by first converting the amount of octane into moles. $n(C_8H_{18}) = \frac{45\times10^3}{114} = 394.74$

According the equation, ΔH = -10108 kJmol^{-1} for the combustion of 2 moles of C_8H_{18}. So, we need to divide by 2 to find the amount of energy released for one mol of octane.

That is; $\frac{10108 \text{ kJmol}^{-1}}{2} = 5054 \text{ kJmol}^{-1}$

Therefore, the amount of energy produced = 394.74 mol × 5054 kJmol^{-1} = 2.0×10^6 kJ

Question 2 ANS A

$Mg_{(s)} \rightarrow Mg^{2+}_{(aq)} + 2e^-$

$Q = It = 2.00 \times 10^{-6} \times 1 = 2.00 \times 10^{-6}$ C

n (e-) = $Q/F = 2 \times 10^{-6} / 96500 = 2.07 \times 10^{-11}$ mol

n (Mg) = $\frac{1}{2} \times 2.07 \times 10^{-11} = 1.0 \times 10^{-11}$ mol

Question 3 ANS D

In an electroplating cell the object being covered with metal is the cathode and is connected to the negative terminal of the power supply. Reduction occurs at the cathode.

Question 4 ANS D

The longer the carbon chain, the greater the dispersion forces between the molecules and, therefore, the more viscous the molecule. Since molecule (D) has the largest number of carbons, it has the longest carbon chain and hence the most viscous molecule in the options.

Question 5 ANS D

To calculate the energy content in each food item, use the data in Section 13 of the Data Book.
Energy in 100g of eggs = (13.0 × 17) + (1.1 × 16) + (11.0 × 37) = 221 + 17.6 + 407 = 645.6 kJ
Energy in 100g of beef = (26.0 × 17) + (0.0 × 16) + (4.0 × 37) = 442 + 0 + 148 = 590 kJ
Energy in 100g of bread = (9.0 × 17) + (35.0 × 16) + (3.0 × 37) = 153 + 560 + 111 = 824 kJ
Energy in 100g of cheese = (25.0 × 17) + (1.3 × 16) + (33.0 × 37) = 425 + 20.8 + 1221 = 1666.8 kJ

Therefore, 100g of cheese has the highest energy content.

Question 6 ANS D

From the graph, it is seen that the peak at the highest mass/charge ratio, *m/z* = 60. This shows that the alkanol has a relative molecular mass of 60.

butan-1-ol M_r (C_4H_9OH) = 74.0 M_r
ethanol M_r (C_2H_5OH) = 46.0
methanol M_r (CH_3OH) = 32.0
propan-1-ol M_r (C_3H_7OH) = 60.0

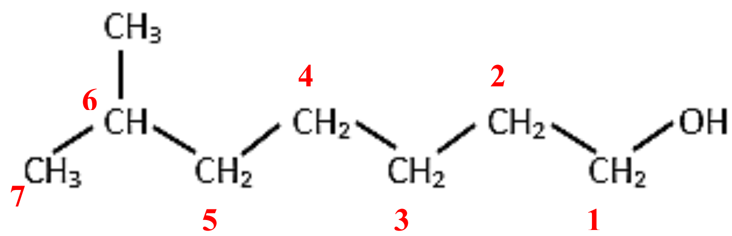
Hence, D: propan-1-ol; is the correct answer.

Question 7 ANS C

This is an oxidation reaction. It is important to remember that

- only primary alkanols can be oxidised to acids
- the functional group is on the lowest possible numbered C atom in the chain.

The alkanol that is oxidised to the acid has the hydroxyl, (-OH) group on the C1. The chain of C atoms is numbered as shown below.



With seven atoms in the chain and a methyl, CH_3, group on C6, the alcohol is 6-methylbutan-1-ol, and has the semi-structural formula $(CH_3)_2CHCH_2CH_2CH_2CH_2CH_2OH$. During oxidation the $–CH_2OH$ is changed to –COOH to give 6-methylheptanoic acid, $(CH_3)_2CHCH_2CH_2CH_2CH_2COOH$.

Question 8 ANS C

Renewable energy sources are those that are readily replenishable. Non-renewable energy sources are those that once used up are not readily replenished. Microbial decomposition of plant material will continue to produce methane as long as plant material is available and so this is a renewable source.

Question 9 ANS B

Glycogen and fats is the correct answer.
Excess energy is usually stored in the body as glycogen. When energy is needed, glycogen is converted into glucose for use by the muscle cells. It is important to remember that glucose does not get stored in the body.

Question 10 ANS A

One of the disadvantages of biodiesel is the difficulty of using it in cold climates. One reason for this is its high viscosity. This causes it to solidify at low temperature and gives poor flow in pipes. Biodiesel also has a high flash point (the lowest temperature at which vapours of the material will ignite); an obivous disadvantage at low temperatures.

Question 11 ANS D

When iron(III) chloride solution is electrolysed using graphite electrodes which are inert, the reduction of Fe^{3+}(aq) ions occurs at the cathode to produce Fe^{2+} (aq) .

Question 12 ANS B

Carbon neutral fuels are those which have no net greenhouse gas emissions or carbon footprint. Biofuels are considered to be carbon neutral because you can replant the trees that you burn for fuel to consume the CO_2 produced. The net carbon emission will be zero because the new tree will bind the same amount of carbon that was released when burning the old tree. However, fossil fuels are not carbon neutral as they are made of hydrocarbons, which when burned produce carbon dioxide. Fossil fuels are not renewable. They cannot be readily replaced when consumed as it takes millions of years for fossil fuels to form.

Question 13 ANS C

This is due to the greater affinity of CO than O_2 for haemoglobin which forces the equilibrium of haemoglobin + oxygen $\rightleftharpoons$ oxyhaemoglobin to the left as the equilibrium of haemoglobin + carbon monoxide $\rightleftharpoons$ carboxyhaemoglobin is established.

Question 14 ANS B

In galvanic cells, the redox reaction is spontaneous and exothermic and chemical energy is converted to electrical energy. However, the reaction in electrolytic cells is not a spontaneous reaction and electrical energy is converted to chemical energy so it is an endothermic reaction.

Question 15 ANS C

Octane is an alkane with the molecular formula C_8H_{18}.
The mass of 1 mol of octane molecules = $(8 \times 12.0) + (18 \times 1.0) = 114$ g.
1 mol of decane molecules contains the Avogadro number of molecules.
From Section 4 of the Data Book, this is 6.02×10^{23}.

Hence, the mass of one molecule of octane = $\frac{114}{6.02\times10^{23}}$ g

Question 16 ANS B

An energy greater than energy X (the activation energy) is needed as this is the amount of energy that must be exceeded for a reaction to occur between the CH_3Cl molecules and the OH^- ions.

Question 17 ANS C
The catalyst lowers the activation energy of both the forward and the reverse reactions.

Question 18 ANS B

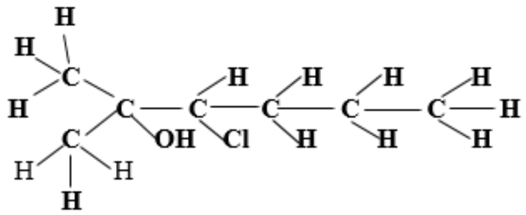
One mol of polyethene has a mass of 1.4×10^4 g. Polyethene has the general formula $(C_2H_4)_n$.

The number of mol of ethene molecules = $\frac{m}{M} = \frac{1.4\times10^4}{28}$.

The number of mol of C atoms = $\frac{1.4\times10^4\times2}{28} = 1000$

Question 19 ANS C

The structural formula for this compound is



From the structure above, it can be seen that this is a six carbon chain (hexane). The methyl group is attached to C2, on which there is also an hydroxyl group (-OH). –Cl is attached to C3.
The systematic name is 3-chloro-2-methylhexan-2-ol.

Question 20 ANS A

Le Chatelier's Principle explains how a system will always partially oppose a change applied to a system at equilibrium to bring the system back to equilibrium. By doing this, the rates of the forward and reverse reactions are made equal once again.

Question 21 ANS C

To obtain the equation $S_{(s)} + O_{2(g)} \rightarrow SO_{2(g)}$, add equations (1) and (2) below and then divide the resulting equation by 2.

$2S_{(s)} + 3O_{2(g)} \rightarrow 2SO_{3(g)}$ (1) $\Delta H = -800$ kJ mol^{-1}

$2SO_{3(g)} \rightarrow 2SO_{2(s)} + O_{2(g)}$ (2) $\Delta H = +200$ kJ mol^{-1}

$2S_{(s)} + 2O_{2(g)} \rightarrow 2SO_{2(g)}$ $\Delta H = -600$ kJ mol^{-1}

$S_{(s)} + O_{2(g)} \rightarrow SO_{2(g)}$ $\Delta H = -300$ kJ mol^{-1}

Question 22 ANS A

The primary structure would be the least affected by the increase in temperature as this structure is the sequence of amino acids held together by strong covalent bonding. The hydrogen bonding in the other structures is far more likely to be disturbed by the temperature rise.

Question 23 ANS C

Adding a catalyst does not shift the position of equilibrium. It just achieves equilibrium more rapidly. Increasing the temperature will favour the endothermic reaction and so shift the equilibrium position to the right. The addition of more reactant *A* will also shift the equilibrium position to the right. Decreasing the volume of the solution has no effect since there is an equal number of mol on both sides of the equation.

Question 24 ANS D

Mass of 4 mol of Al = 4 × 27.0 = 108 g
108 g of Al requires 3352 kJ,

The amount of heat required to produce 200 g of Al = $\frac{200}{108} \times 3352$

= 6207 kJ

Note: The *ΔH* value quoted is per mol of equation **as written**.
That is, 2 mol of Al_2O_3 , 4 mol of Al and 3 mol of O_2.

Question 25 ANS B

See Section 17 of the Data Book. All amino acids have an $–NH_2$ and a –COOH group attached to the same carbon atom.

Question 26 ANS D

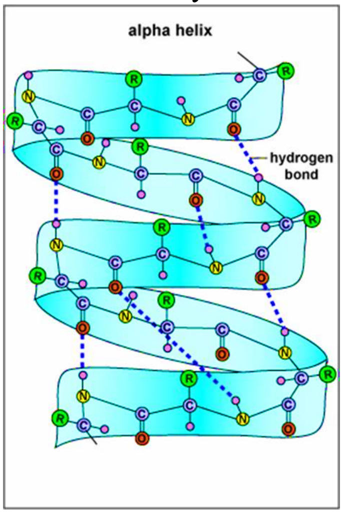
The different hydrogen environments are 4 and 3 respectively. The different carbon environments are 3 and 2 respectively. Hence, **A** and **C** are true. The molecular mass of each is 60 so this peak would occur in both mass spectra. **B** is true. Both compounds would have very similar IR troughs in the area around 3000 (due to the –OH group), but the fingerprint region between 1500 and 500 cm^{-1} would be different.

Question 27 ANS A

Humans are unable to digest cellulose because they do not have necessary enzymes required for cellulose digestion, nor do they have symbiotic bacteria to perform the digestion for them. They can digest starch because they have the required enzymes to break it down. Therefore, cellulose provides the lowest amount of energy per gram as it is not significantly digested in the human body.

Question 28 ANS B

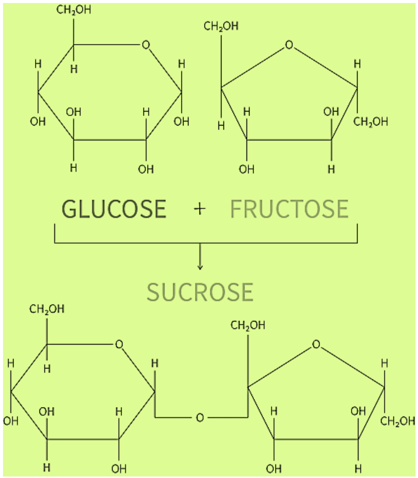
The hydrogen bonding between the N-H group of one amino acid and the O=C group of another amino acid produces the helical shape in the secondary structure of a protein. See the diagram below.



Question 29 ANS B

See Section 10 of the Data Book.

When glucose reacts with fructose, the disaccharide, sucrose, is produced.



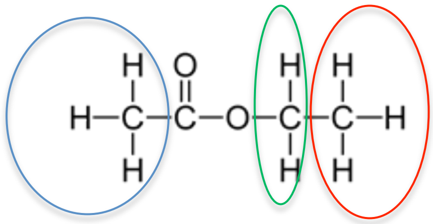
Question 30 ANS A

Condensation is the combination of two molecules with the production of another small molecule. For example, when amino acids combine to form a dipeptide and water as shown in the equation below:

$NH_2CH_2COOH(aq) + NH_2CH_2COOH(aq) \rightarrow NH_2CH_2CONHCH_2COOH(aq) + H_2O(l)$

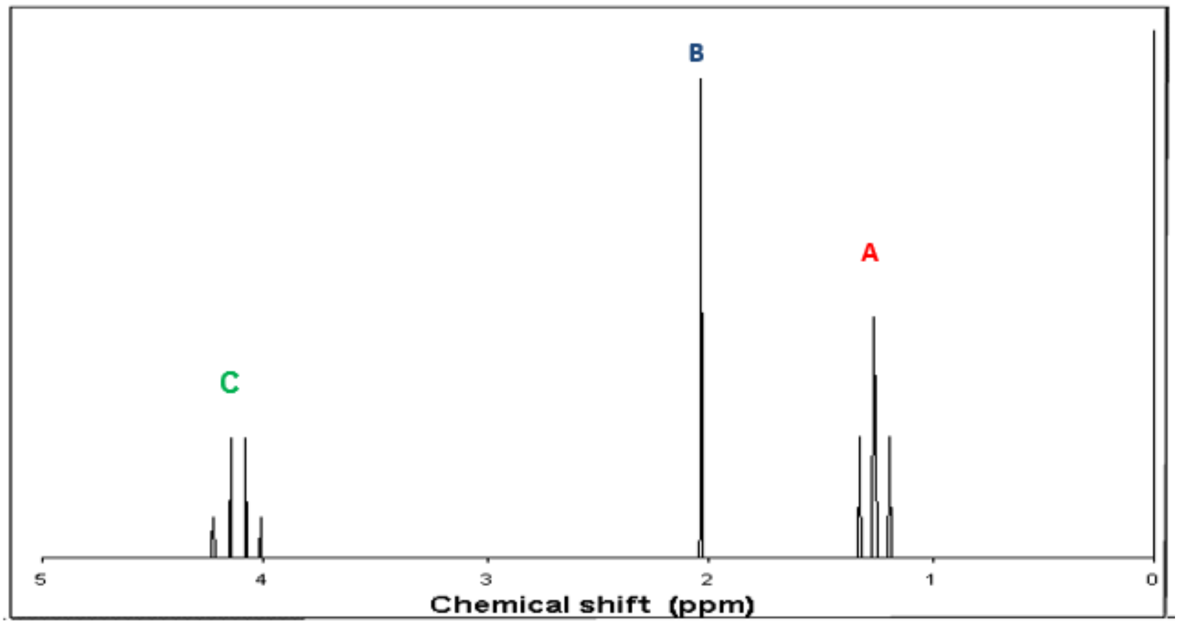
END OF ANSWERS
SECTION A

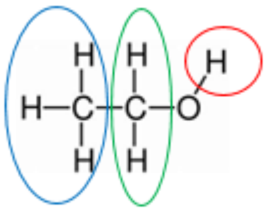
Question 1 (6 marks)



a. **i.** Spectrum A: ethyl ethanoate

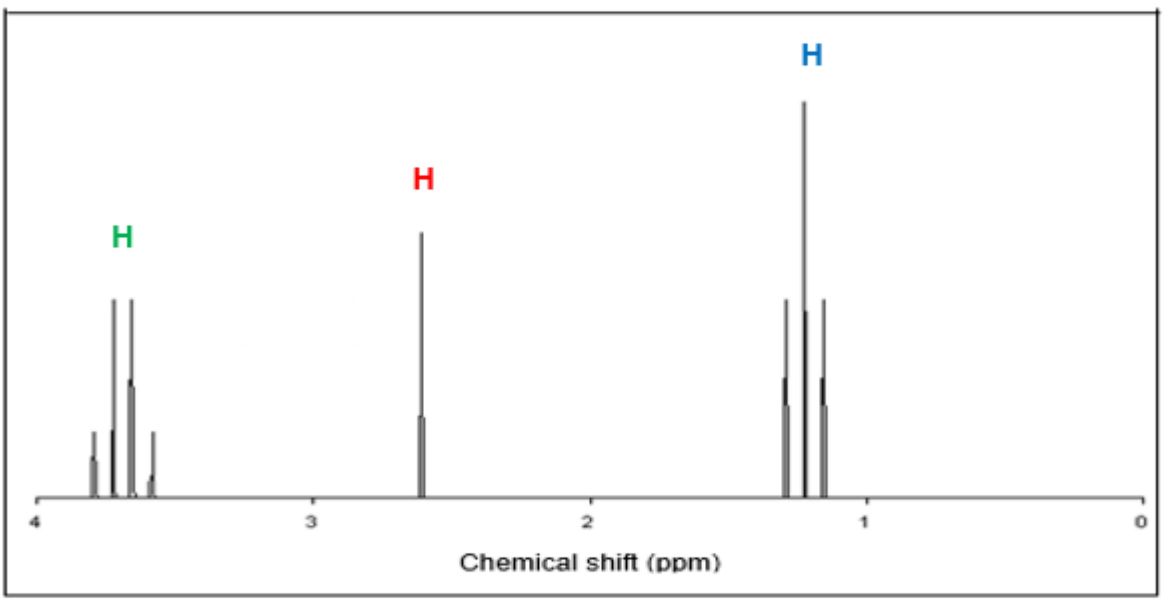
(1 mark)





Spectrum B**:** ethanol

(1 mark)



Question 1 (continued)

a. ii.
The single line peak in **Spectrum A** is higher than the single line peak in **Spectrum B** because it is 3 hydrogens instead of 1. This identifies **Spectrum A** as ethyl ethanoate.

Spectrum A is ethyl ethanoate (ethyl acetate): there are three H environments: A:B:C with 3:3:2 hydrogens respectively. The chemical shift between 4-5 is due to the $–CH_2$ environment showing 4 splits for the 3 neighbour H atoms (n+1), the chemical shift at 2.0 is due to the $–CH_3$ attached to the =O with zero H neighbour atoms (n +1) showing 1 peak, and a chemical shift at 1.3 due to the $–CH_3$ with 2 neighbour H atoms (CH_2), showing three splits (n + 1).

(1 mark)

Spectrum B is ethanol: there are three peaks due to three different hydrogen environments A:B:C with 1:2:3 hydrogen atoms respectively. There is a chemical shift at 1.3 due to the $-CH_3$, showing three splits due to the two neighbour H atoms (n +1). Another peak is due to $–CH_2$- with four splits due to the 3 neighbouring H-atoms (n +1) and a chemical shift at between 2- 3 due to the –OH group with zero neighbour H atoms.

(1 mark)

b.

A corresponds to a C=O peak for an ester at 1720-1840 cm^{-1} as shown in the Data Book Section 14.

(1 mark)

B is most likely the C-H peak at 2850-3090 cm^{-1} as shown in the Data Book Section 14.

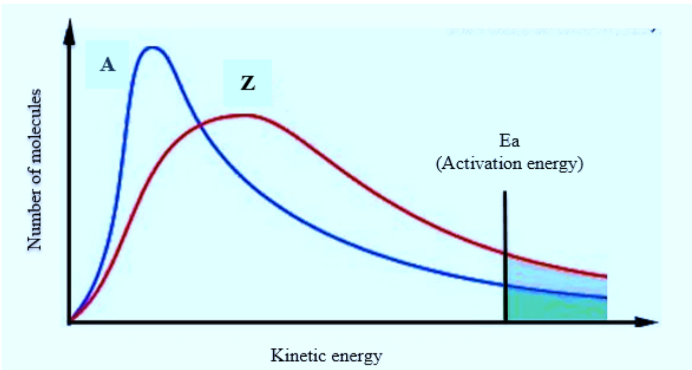
(1 mark)

Question 2 (5 marks)

a. Number of molecules

(1 mark)

b.



(2 marks)

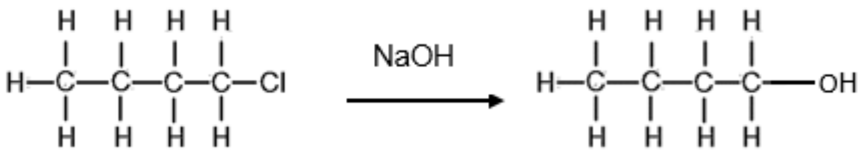
c. The Maxwell Boltzmann distribution of gas molecules shows the distribution of molecular energies in a gas. As the temperature increases, the peak of the line moves lower and shifts to the right. This change in the graph is due to the increase of kinetic energy caused by the increase in temperature which results in increasing the number of gas molecules with kinetic energy greater than the activation energy which is the minimum energy required for a reaction to occur. The activation energy does not change.

(2 marks)

Question 3 (8 marks)

a.

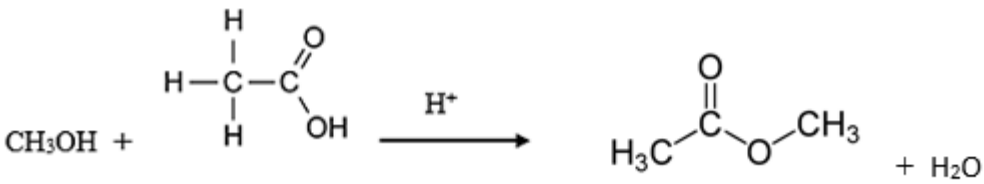
i.



(Butan-1-ol)

(2 marks)

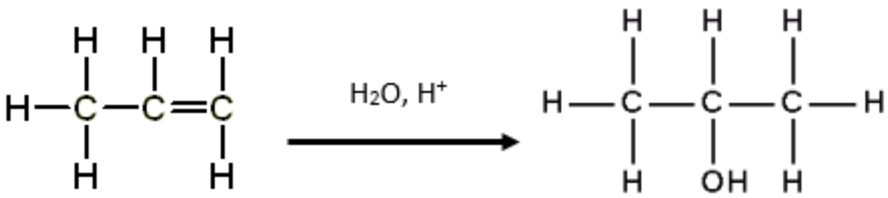
ii.



(Methyl ethanoate)

(2 marks)

iii.



(2-propanol)

(2 marks)

b. **i.** Substitution reaction

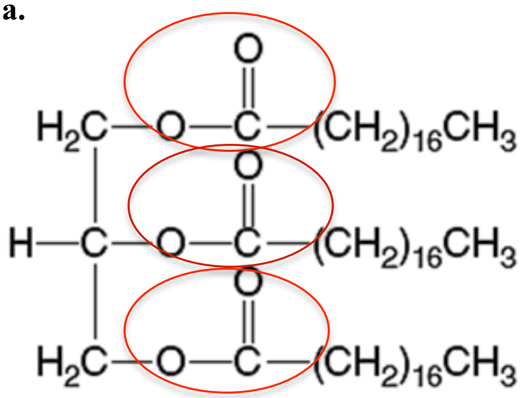
(1 mark)

ii. Esters

(1 mark)

Question 4 (10 marks)

a.



(1 mark)

b. Tristearin is the primary fat in beef. It is a triglyceride, a molecule of triglycerides that has reacted with three molecules of the fatty acid (steric acid). It is a saturated fat. This means that every carbon has as many hydrogen atoms as it can hold (it is saturated with hydrogen), and there are no double bonds between any two carbons.

(1 mark)

c. Tristearin is a triglyceride with three molecules of stearic acid connected to a glycerol molecule by means of ester linkages.

Product 1: Stearic Acid

(1 mark)

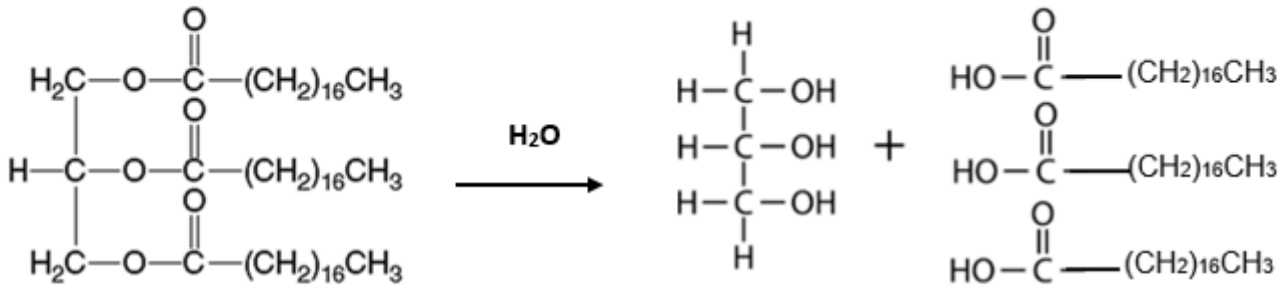
Product 2: Glycerol

(1 mark)

d. Hydrolysis reaction

(1 mark)

e.



(1 mark)

Question 4 (continued)

f. **i.** Monounsaturated fats/ triglycerides contain fatty acids that have one carbon-carbon double bond. (C=C).

(1 mark)

ii. Polyunsaturated fats/triglycerides contain fatty acids that have multiple carbon-carbon double bonds. (C=C)

(1 mark)

g. Unsaturated fats are less stable due to the presence of the double bond between two or more carbon atoms as it does not require a great amount of energy to break one of the double bonds. The double bond also makes the fat more susceptible to oxidation than saturated fats because oxygen in the air reacts across the double bond.

(1 mark)

h. Unsaturated fats can be converted to saturated fats by the addition of hydrogen .(hydrogenation)

(1 mark)

Question 5 (11 marks)

a. **i.** Carboxyl group: -COOH

(1 mark)

ii. Amine group: $-NH_2$

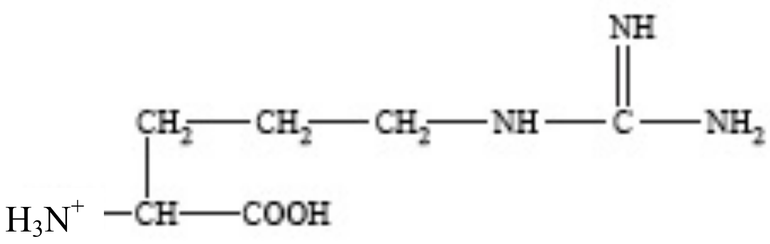
(1 mark)

b. Essential amino acids are those that **cannot** be synthesised in the body and must be obtained from food intake. That is, they are essential in the diet. Non-essential amino acids are those that **can** be synthesised in the body by using materials that are taken in the diet.

(1 mark)

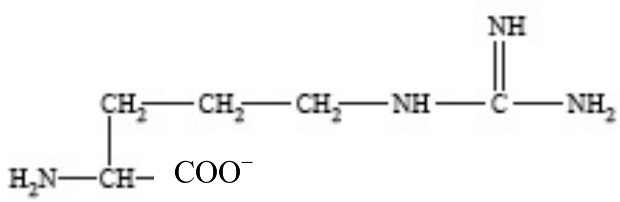
c.

i. Arginine in an acidic solution of pH = 2.4 (an excess of H^+ ions). Also accept structures showing an extra H on one or more of the other N atoms. Must have a + sign on the N.



(1 mark)

ii. Arginine in a basic solution of pH = 8 (an excess of OH^- ions)



(1 mark)

Question 5 (continued)

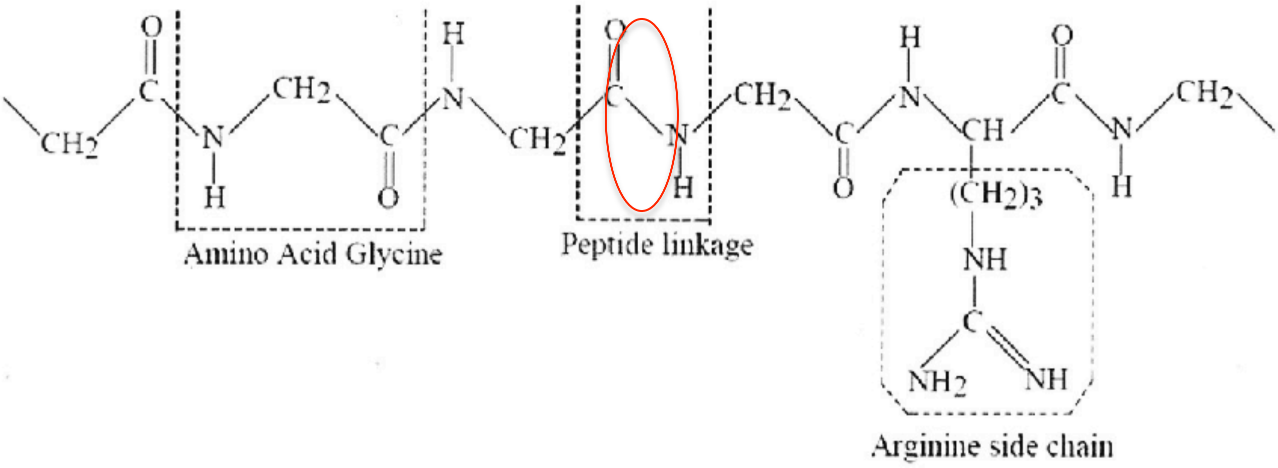
d. **i.** polypeptide

(1 mark)

ii. hydrolysis

(1 mark)

iii. one bond shown below



(1 mark)

iv. peptide link

(1 mark)

e. Students should do a careful analysis of Section 17 of the Data Book to prepare for questions on the structure and function of amino acids.

i.	An amino acid with a polar side chain	Any one of: (not necessarily an exhaustive set) - asparagine - glutamine - serine - threonine - tyrosine (1 mark)
ii.	An amino acid with a non-polar side chain	Any one of: (not necessarily an exhaustive set) - alanine - glycine - isoleucine - leucine - methionine - phenylalanine - proline - valine (1 mark)

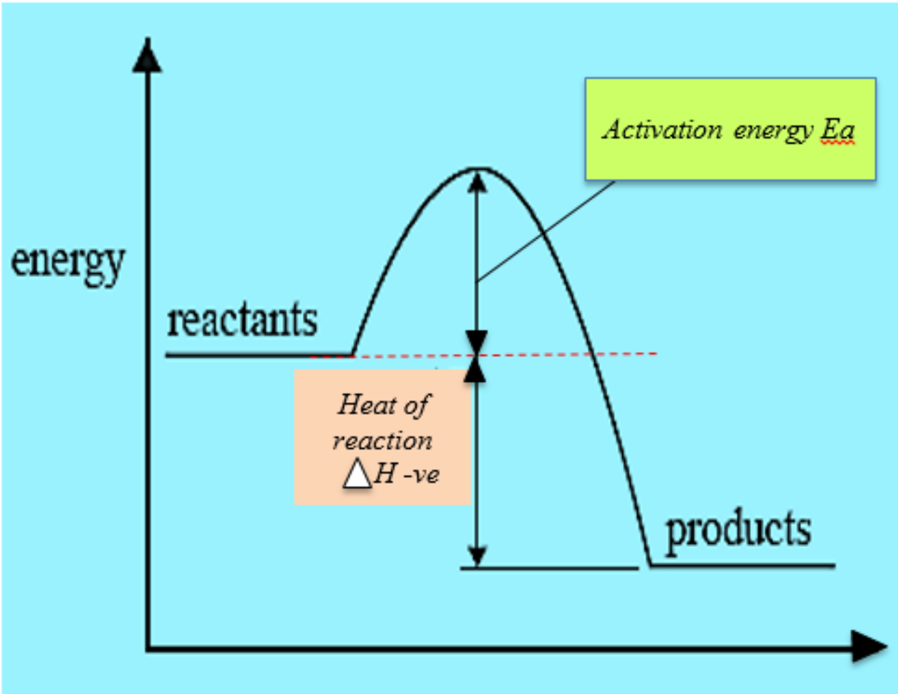
Question 6 (8 marks)

a. i. Energy profile diagram below

(1 mark)

ii. ΔH and E_a on the diagram below.

(1 mark)



b. More energy is stored in the reactants $C_4H_{10}(g)$ and $O_2(g)$ than in the products $CO_2(g)$ and $H_2O(g)$ because energy is released in this chemical reaction as shown by the negative ΔH value.

(1 mark)

c. $n(C_4H_{10}) = \frac{20.0}{58}$ mol

(1 mark)

From the balanced equation, 2 mol of butane produces 5760 kJ

Therefore, energy released from $\frac{20.0}{58}$ mol $= 5760 \times \frac{20.0}{58} \times \frac{1}{2} = 993.1$ kJ

Therefore, 993 kJ is produced when 20 g of butane burns completely.

(1 mark)

Question 6 (continued)

d. $n(C_4H_{10}) = \frac{20.0}{58}$ mol

n(products) = n(CO_2) + n(H_2O) = $\left(4\times\frac{20.0}{58}\right)+\left(5\times\frac{20.0}{58}\right)$ mol

(1 mark)

m(products) = m(CO_2) + m(H_2O) = $\left(4\times\frac{20.0}{58}\times 44\right)+\left(5\times\frac{20.0}{58}\times 18\right)$ g

= 60.69 + 31.03

= 91.7 g

(1 mark)

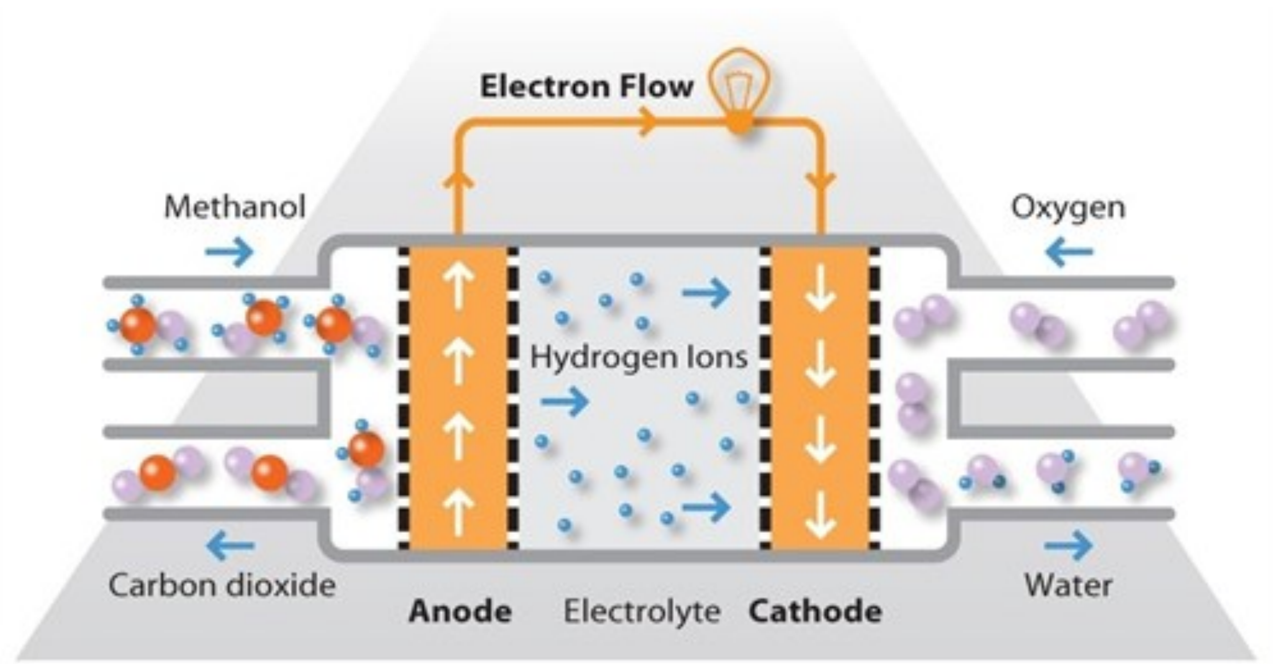
e. $m(O_2) = \frac{20.0}{58}\times\frac{13}{2}\times 32 = 71.7$ g

OR (much easier!) m(O_2) = 91.7 – 20.0 = 71.7 g

(1 mark)

Question 7 (8 marks)

a. The anode (oxidation) and the cathode (reduction) are labelled below.



(1 mark)

Question 7 (continued)

b. **i.** Oxidation reaction occurs at the anode.

$CH_{4\,(g)} + 2H_2O_{(l)} \longrightarrow CO_{2(g)} + 8H^+ + 8e^-$

(1 mark)

ii. Reduction reaction occurs at the cathode.

$O_2(g) + 4H^+ + 4e^- \longrightarrow 2H_2O_{(l)}$

(1 mark)

iii. Overall equation (Multiply **ii.** by 2 and add to **i.**)

$CH_{4\,(g)} + 2O_{2(g)} \longrightarrow CO_{2(g)} + 2H_2O_{(g)}$

(1 mark)

c. pH would remain the same.

(1 mark)

Hydrogen ions are being produced at the anode and consumed at the cathode in the same quantity.

(1 mark)

d. **Advantages:**

- Very efficient
- Direct conversion of chemical energy into electrical energy
- Methane fuel cells are safer to use than hydrogen fuel cells.
- Provides continuous flow of electricity

(1 mark)

Disadvantages:

- Not available to the average person
- Only small scale appication
- Produces carbon dioxide which is a greenhouse gas
- It is still going through development
- Requires a large capital investment to incorporate into the infrastructure.

(1 mark)

Question 8 (7 marks)

a. Production of $CO_{2(g)}$ as the acid reacts with the nickel carbonate

(1 mark)

b. The boric acid controls the pH of the solution during the electrolysis.

(1 mark)

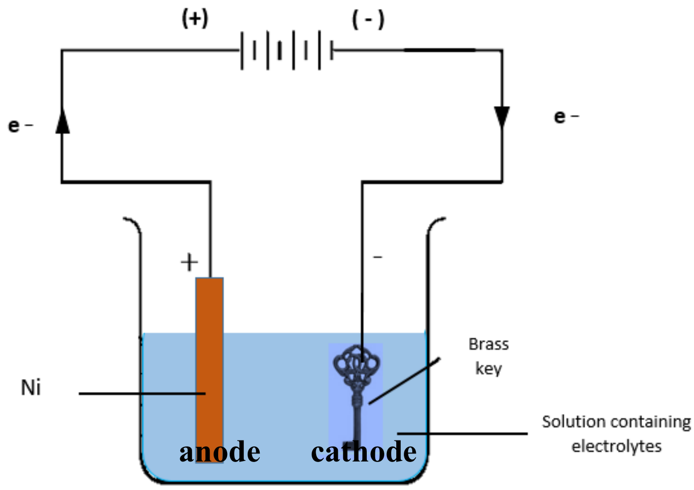
c. **i.** Anode half reaction: $Ni_{(s)} \longrightarrow Ni^{2+}_{(aq)} + 2e^-$

(1 mark)

ii. Cathode half reaction: $Ni^{2+}_{(aq)} + 2e^- \longrightarrow Ni_{(s)}$

(1 mark)

d.



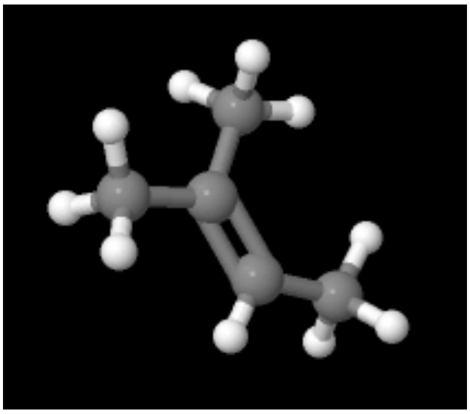
(1 mark)

e.

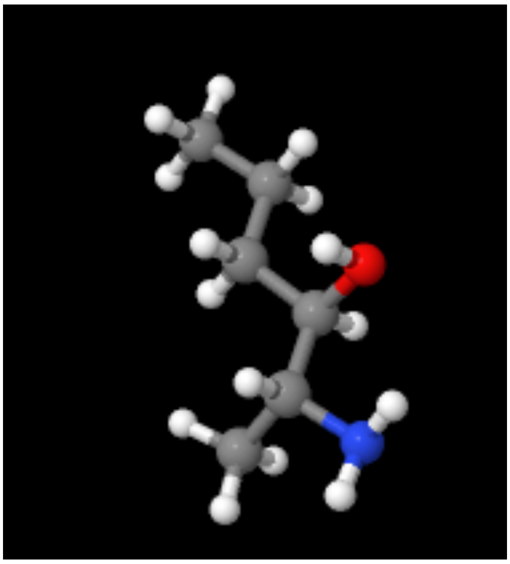
Step 1: calculate time (t) t = 48 hours = 20 × 60 × 60 = 72 000 s	**Step 2**: calculate the number of mol of electrons $n(e^-) = \frac{Q}{F} = \frac{I \times t}{F} = \frac{0.2 \times 72000}{96500}$ =0.149 mol (1 mark)
Step 3: calculate the number of mol of nickel deposited by using the mol ratio in the equation. n(Ni) = ½ × n(e-) ½ × 0.149 = 0.0746 mol	**Step 4**: mass of nickel deposited $m = n \times M$ m(Ni) = 0.0746 × 58.7 = 4.379 g = 4.4 g (1 mark)

Question 9 (9 marks)

a. (Both answers in each part must be correct to gain the 1 mark)

Semi-structural formula	Structural formula	IUPAC name
$(CH_3)_2CCHCH_3$		2-methylbut-2-ene

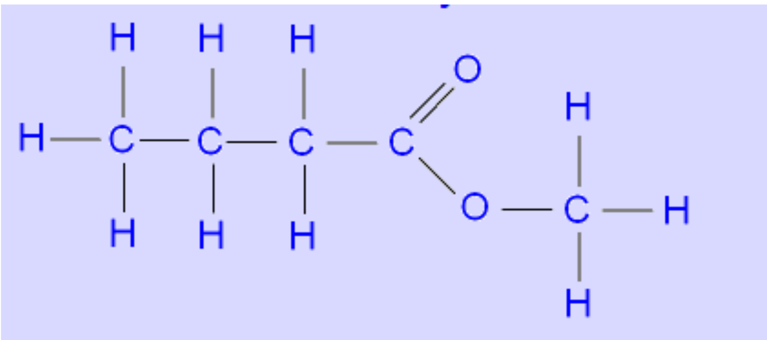
(1 mark)

Semi-structural formula	Structural formula	IUPAC name
$CH_3CH(NH_2)CH(OH)CH_2CH_2CH_3$		2-amino-hexan-3-ol

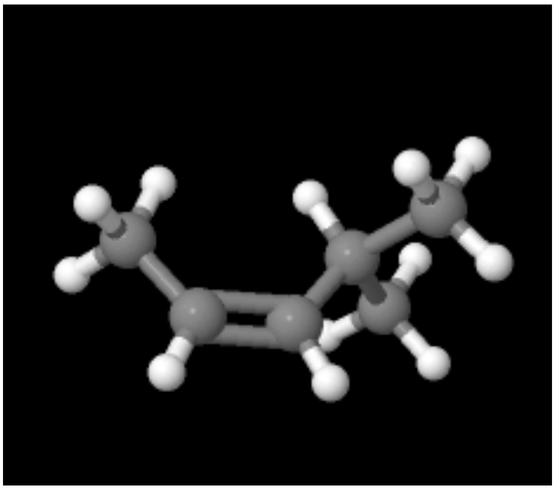
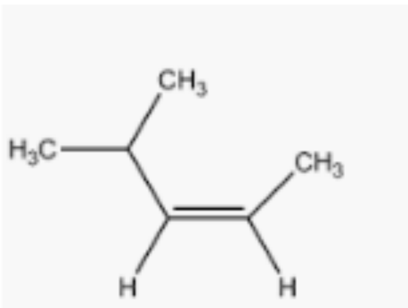
(1 mark)

Question 9 (continued)

a. (continued)

Semi-structural formula	**Structural formula**	**IUPAC name**
$CH_3OCOCH_2CH_3$		methyl butanoate

(1 mark)

Semi-structural formula	**Structural formula**	**IUPAC name**
$CH_3CH(CH_3)CHCHCH_3$	 	*cis*-4-methylpent-2-ene

(1 mark)

Question 9 (continued)

b. **i.** $CH_3CH_2CH_2OH \xrightarrow{Cr_2O_7^{2-}(aq) / H^+} CH_3CH_2COOH$

(1 mark)

ii. $CH_3CH_2OH + CH_3CH_2COOH \xrightarrow{H^+ / H_2O} CH_3CH_2COOCH_2CH_3 + H_2O$

(1 mark)

c. A chiral carbon or asymmetric carbon atom is a carbon atom that is attached to four different types of atoms or groups of atoms.

(1 mark)

d. **i.** zero chiral carbons

(1 mark)

ii. 1 chiral carbon

(1 mark)

Question 10 (9 marks)

a. $CH_3COOH_{(aq)} + NaOH_{(aq)} \longrightarrow CH_3COONa_{(aq)} + H_2O_{(l)}$

(1 mark)

b. The purpose of repeating titrations is to ensure the precision and accuracy of the measurement.

Titrations must be repeated until at least three concordant titres are obtained. A minimum of three titres need to be all within 0.05 mL. These titres are not concordant. This student needed to do at least one more titration.

(1 mark)

c. The amount of sodium hydroxide, in mol, used in the titration.

Titre average can be calculated by taking the average of the three titre values

$$V(\text{NaOH}) = \frac{19.50+19.55+19.70}{3} = 19.58 \text{ mL}$$

(1 mark)

$$n(\text{NaOH}) = c \times V = 1.00 \times 0.01958 = 0.01958 \text{ mol}$$

(1 mark)

Question 10 (continued)

d. *Use the mol ratio from the equation to calculate the number of moles of ethanoic acid that reacted with the standard solution.*

Mol ratio NaOH: CH_3COOH is 1:1

Therefore, the number of moles of ethanoic acid that reacted is the same as the number of moles of NaOH = 0.01958 mol

(1 mark)

e. $c(CH_3COOH) = \frac{n}{V} = \frac{0.01958}{0.02} = 0.979 = 0.98$ M

(1 mark)

f. This is a titration between a strong base (NaOH) and a weak acid (CH_3COOH). A suitable indicator is one that changes colour close to the equivalence point for the chemical reaction. The best indicators for this reaction are those that change colour in a pH range greater than 7 like phenolphthalein. See section 7 of the Data Book.

bromothymol blue	6.0–7.6	yellow → blue
phenol red	6.8–8.4	yellow → red
thymol blue (2nd change)	8.0–9.6	yellow → blue
phenolphthalein	8.3–10.0	colourless → pink

(1 mark)

g. **Any of the following:**
- Using an unsuitable indicator
- Not using concordant titres
- Contamination of the sample
- Difficultly judging the permanent change of colour (end point)
- Changing in the volume of the sample due to fluctuations
- Difficulty identifying the reading between 0.1 mL scale of the burette

(2 marks)

Question 11 (9 marks)

a. $$K_c = \frac{[C]_e[D]_e^2}{[A]_e^2[B]_e}$$

(1 mark)

b. Test 1 – darker. Equilibrium shifts to the left as more product is added.

(1 mark)

Test 2 – darker. Equilibrium shifts to the left as reactant is removed.

(1 mark)

Test 3 – lighter. Equilibrium shifts to the right as endothermic reaction is favoured.

(1 mark)

Test 4 – no change. A catalyst does not change the position of equilibrium.

(1 mark)

c. Test 1 – Equal to 5.5. No change in temperature. Therefore, no change in K_c.

(1 mark)

Test 2 – Equal to 5.5. No change in temperature. Therefore, no change in K_c.

(1 mark)

Test 3 – Greater than 5.5. An increase in temperature for an endothermic reaction increases the value of K_c.

(1 mark)

Test 4 – Equal to 5.5. A catalyst only increases the rate at which equilibrium is reached.

(1 mark)

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Detailed Answers

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Useful Web Links for further study of VCE Chemistry

http://www.chemguide.co.uk/physical/equilibria/haber.html

http://www.chemistry.adelaide.edu.au/external/soc-rel/content/standard.htm

http://www.chemguide.co.uk/physical/acidbaseeqia/acids.html#top

http://www.chemguide.co.uk/analysis/chromatography/thinlayer.html#top

http://www.ausetute.com.au/massmole.html

http://www.webqc.org/balance.php

http://www.chemguide.co.uk/physical/redoxeqia/ecs.html

http://www.chemguide.co.uk/physical/equilibria/lechatelier.html#top

http://www.chemguide.co.uk/physical/equilibria/lechatelier.html

http://www.chemguide.co.uk/physical/acidbaseeqia/acids.html#top

http://www.chemguide.co.uk/physical/acidbaseeqia/acids.html#top

http://www.chemguide.co.uk/organicprops/alkenes/polymerisation.html#top

http://www.chemguide.co.uk/basicorg/conventions/names.html#top

http://www.chemguide.co.uk/physical/energetics/neutralisation.html#top

http://chemed.chem.wisc.edu/chempaths/GenChem-Textbook/Galvanic-Cells-699.html

http://www.chemguide.co.uk/physical/redoxeqia/ecs.html#top

http://chemed.chem.purdue.edu/genchem/topicreview/bp/ch20/faraday.php

http://www.princeton.edu/~achaney/tmve/wiki100k/docs/Ether.html

http://tasisbio.blogspot.com.au/2012/10/molecules-joining.html

http://www.elmhurst.edu/~chm/vchembook/547glycogen.html

http://www.chembio.uoguelph.ca/chemzine/v1i1feb02/page6.shtml

Useful Web Links for further study of VCE Chemistry (continued)

http://www.chemguide.co.uk/physical/redoxeqia/ecs.html

http://www.genericmaker.com/2012_04_01_archive.html

http://en.wikipedia.org/wiki/Alpha-Linolenic_acid

http://www.chemguide.co.uk/organicprops/aminoacids/dna1.html

http://en.wikipedia.org/wiki/IUPAC_nomenclature_of_organic_chemistry#Alcohols

http://chemwiki.ucdavis.edu/Organic_Chemistry/Alcohols/Naming_Alcohols

http://www.chemguide.co.uk/analysis/ir/fingerprint.html#top

http://www.chemguide.co.uk/analysis/uvvisible/radiation.html#top

http://www.chemguide.co.uk/analysis/masspec/howitworks.html

www.educationscotland.gov.uk/images/chemmolecalcsunitlabel_tcm4-148466.pdf

http://www.chemguide.co.uk/physical/kt/idealgases.html#top

http://www.chemguide.co.uk/analysis/chromatography/gas.html#top

http://www.bbc.co.uk/bitesize/higher/chemistry/calculations_3/redox_titr/revision/1/

http://en.wikipedia.org/wiki/Ethylene

http://bit.ly/WYNVr5

http://bit.ly/1aiFW2R

http://science.howstuffworks.com/environmental/energy/natural-gas-renewable3.htm

http://www.youtube.com/watch?v=yumnYB_iGfU

Useful Web Links for further study of VCE Chemistry (continued)

http://www.youtube.com/watch?v=mfDApGo8PC0

http://click4biology.info/c4b/3/images/3.2/dipeptide.gif

http://firstyear.chem.usyd.edu.au/bridging_course/Questions/electrolysis.htm

http://www.chemguide.co.uk/physical/catalysis/esterify.html

http://www.chemguide.co.uk/organicprops/aminoacids/proteinstruct.html

http://chemed.chem.wisc.edu/chempaths/GenChem-Textbook/Disaccharides-1022.html

http://www.chemguide.co.uk/physical/acidbaseeqia/acids.html

http://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/Spectrpy/nmr/nmr1.htm

http://www.files.chem.vt.edu/chem-ed/spec/atomic/aa.html

http://www.chemguide.co.uk/analysis/chromatography/paper.html

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