2020 VCE Chemistry Trial Examination Detailed Answers

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Answer Summary for Multiple-Choice Questions
2020 Kilbaha VCE Chemistry Trial Examination

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

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

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

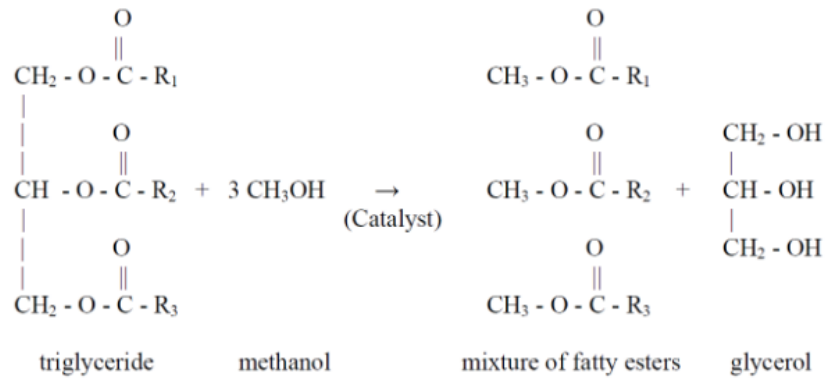
Answer distribution:	A	B	C	D
	7	8	7	8

Question 1 ANS A

The **inter**molecular bonding in biodiesel is stronger than that in petrodiesel because the hydrocarbon chain in biodiesel is longer and contains electronegative oxygen atoms which form dipole-dipole bonds between neigbouring molecules. Hence, both the viscosity and melting points of biodiesel are greater than those of petrodiesel.

Question 2 ANS B

Biodiesel is not a pure substance. It is a mixture of fatty acid methyl esters formed from triglycerides and methanol as shown in the example below.



Question 3 ANS B

The semi-structural formula is $CH_2OHCHOHCH_2OH$. The molecular formula is $C_3H_8O_3$. Hence, the molar mass = (3x12)+(8x1)+(3x16) = 36 + 8 +48 = 92 g mol^{-1}.

Question 4 ANS C

From the Data Book, Section 9 – Formulas of some fatty acids, arachidonic acid has the molecular formula $C_{19}H_{31}COOH$ and the semi-structural formula $CH_3(CH_2)_4(CH{=}CHCH_2)_3CH{=}CH(CH_2)_3COOH$. This shows that there are 3 + 1 = 4 carbon-carbon double bonds.

Question 5 ANS A

If the Ni(s) electrode is negative, it is giving up electrons. From the Data Book, Section 2 – electrochemical series, it can be seen that if the Ni(s) electrode is negative, it must be reacting with either Pb^{2+}(aq) to give a voltage of 0.12 V or Cu^{2+}(aq) to give a voltage of **0.59 V**. There is a larger cell voltage (1.41 V) with Al^{3+}(aq) / Al(s) but in this case the Ni(s) electrode is positive.

Question 6 ANS D

A catalyst lowers the activation energy of both the forward and the reverse reactions. It does not change the difference in energy content (ΔH) between the reactants and the products.

Question 7 ANS B

To produce Na(s) from Na^+(aq), a reduction reaction must occur. This will be at the cathode. However, from the Data Book, Section 2 – electrochemical series, H_2O(l) is a stronger oxidising agent (-0.83 V) than Na^+(aq) (-2.71 V). H_2(g) is produced at the cathode not Na(s).

Question 8 ANS B

If you are using an acidic environment, the relevant half-equations from the Data Book, Section 2 – electrochemical series are:

$O_2(g) + 4H^+(aq) + 4e^- \rightleftharpoons 2H_2O(l)$ E^0 = +1.23 V and

$2H^+(aq) + 2e^- \rightleftharpoons H_2O(g)$ E^0 = 0.00 V. Cell voltage = 1.23 – 0.00 = 1.23 V.

If you are using an alkaline environment, the relevant half-equations from the Data Book, Section 2 – electrochemical series are:

$O_2(g) + 2H_2O(l) + 4e^- \rightleftharpoons 4OH^-(aq)$ E^0 = +0.40 V and

$2H_2O(l) + 2e^- \rightleftharpoons H_2(g) + 2OH^-(aq)$ E^0 = -0.83 V. Cell voltage = 0.40 – (-0.83)= 1.23 V.

Question 9 ANS A

$\Delta H = H$(products) – H(reactants) is the correct answer. ΔH does not depend on the activation energy of the reaction. It is simply the difference in energy content between the products and the reactants.

Question 10 ANS A

Flashpoint is the lowest temperature at which vapours of a material will ignite. As the temperature rises there will be more butane vapour than octane vapour because the dispersion forces between butane molecules (C_4H_{10}) are smaller than those between octane molecules (C_8H_{16}). See Data Book Section 11 for formulas. Hence, butane will ignite more easily. The flashpoint of octane is higher.

Question 11 ANS C

A chemical reaction only occurs when reactants have enough energy to overcome the energy barrier (activation energy) to make the collisions successful. Increasing the frequency of collisions is not a sufficient condition for a reaction to occur. An increase in temperature will raise the average kinetic energy of the reactant molecules. Therefore, a greater proportion of molecules will have the minimum energy necessary for an effective collision.

Question 12 ANS D

More information is required to determine the yield of product. If the forward reaction is exothermic and the temperature is increased, the yield of the product at equilibrium will decrease. However, If the forward reaction is endothermic and the temperature is increased, the yield of the product at equilibrium will increase.

Question 13 ANS C

A glycosidic link is C–O–C. In the Data Book Section 10 – Formulas of some biomolecules, the structural formulas of sucrose and α-lactose show this glycosidic link.

Question 14 ANS A

Cellulose has alternating CH_2OH groups on adjacent monomers. This structure gives good alignment of neighbouring molecules and significant hydrogen bonding between –OH groups. The human body lacks the enzyme needed to break down this structure. Amylose (starch) has a linear structure like cellulose. The number of glycosidic links is the same (depending, of course, on the polymer length). Cellulose is a polymer of β-glucose.

Question 15 ANS B

In an saturated fatty acid, all the carbon-carbon bonds are single and there is a full complement of hydrogen atoms. Number of hydrogen atoms in the hydrocarbon chain = 2 x number of carbon atoms + 1. C_xH_{2x+1}. For example, stearic acid $C_{17}H_{35}COOH$.

Question 16 ANS C

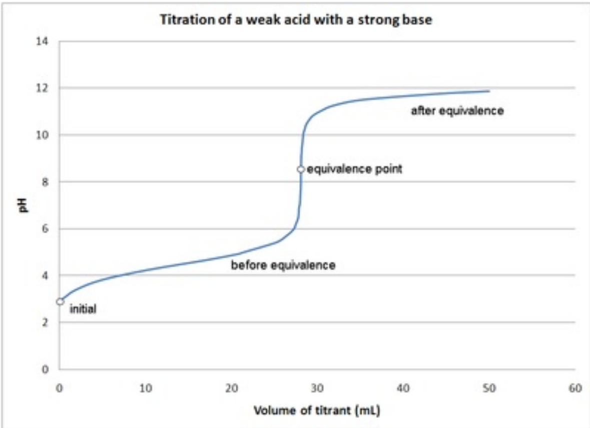
One mole of the unsaturated fatty acid reacts exactly with one mole of hydrogen gas. Therefore, the unsaturated fatty acid must be monounsaturated. One carbon-carbon double bond. From the Data Book Section 9 – Formulas of some fatty acids, only palmitoleic and oleic acids are monounsaturated.

Question 17 ANS B

The energy released in the reaction is the **difference** in energy between the products and the reactants. This is shown in the diagram as **Y**.

Question 18 ANS D

This is the reaction between a strong base (NaOH) and a weak acid (CH_3COOH). Therefore, the end point is best indicated by an indicator that changes colour in a pH range greater than 7. This is shown in the diagram below. Of the indicators listed only phenolphthalein would be suitable. See Data Book Section 7 Acid-base indicators.



https://bit.ly/2ZhUOgW

Question 19 ANS B

The balanced equation for this reaction is $CH_3COOH(aq) + NaOH(aq) \rightarrow CH_3COONa(aq) + H_2O(l)$. The equivalence point occurs when there are equimolar amounts of NaOH(aq) and $CH_3COOH(aq)$. The end point is the colour change.

Question 20 ANS D

The equilibrium expression for the equation: $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ is shown below.

$$K_c = \frac{[NH_3]^2}{[N_2][H_2]^3}$$

$$Z = \frac{X^2}{Y[H_2]^3}$$

$$[H_2]^3 = \frac{X^2}{YZ}$$

$$[H_2] = \sqrt[3]{\frac{X^2}{YZ}}$$

Question 21 ANS A

Use Le Chatelier's Principle. According to Le Chatelier's Principle, the system reacts to partially oppose the changes forced upon it. Since the forward reaction is exothermic, the yield will be increased by low temperatures. Since there are 2 mol of products and 4 mol of reactants, the yield will be increased by high pressures.

Question 22 ANS A

When the temperature is increased a greater proportion of the molecules have higher energies so the graph shifts to the right. The total number of molecules remains the same so the area under the graph remains the same and the maximum point on the graph has a lower value as shown below.

Question 23 ANS D

The molecules in ice have less energy than the molecules in liquid water. They are not moving around as freely. Therefore, when ice forms, energy is released and the energy of the system, the potential energy, decreases. A negative value of ΔH indicates the release of energy in an exothermic reaction. ΔH is negative for a transition from a less ordered state to a more ordered state. Potential energy decreases from a less ordered state to a more ordered state.

Question 24 ANS C

Use the Data Book Section 3 – chemical relationships and Section 4 – Physical constants and standard values.

The chemical reaction is $Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$.

Therefore, $n(e^-) = 2 \times n(Cu^{2+}) = 2 \times c \times V = 2 \times 0.5 = 3.0 = 3.0$ mol.

$Q = n(e^-) \times F = 3.0 \times 96500$ and $Q = I \times t = 8.65 \times t$

$$t = \frac{Q}{I} = \frac{3 \times 96500}{8.65} \times \frac{1}{3600} \text{ hours}$$
$$t = 9.3 \text{ hours}$$

Question 25 ANS D

$[H_2] = 2$, $[I_2] = 4$, $[HI] = 6$. When the volume is halved from 1.0 L to 0.5 L, each of the concentrations is doubled from its original concentration. Since there are 2 mol of gas in both the reactants and the products, there is no change in the position of equilibrium.

Question 26 ANS D

The balanced equation for this reaction is $2CH_3OH(l) + 3O_2(g) \rightarrow 2CO_2(g) + 4H_2O(g)$.

Question 27 ANS B

From the Data Book Section 11 Heats of combustion of common fuels, the heat of combustion of methanol = 22.7 kJ g^{-1}. Use the Data Book Section 3 Chemical relationships to obtain the formula for the heat energy released in the combustion of a fuel. $q = mc\Delta T$. Use the Data Book Section 4 Physical constants and standard values to find the specific heat capacity (c) of water.

$$\Delta T = \frac{q}{mc} = \frac{22.7}{0.25 \times 4.18} = 21.7\,^{0}\text{C}$$

Question 28 ANS D

Molecule A has 4 unique carbon environments and, therefore, 4 peaks. Molecule B has 6 unique carbon environments and, therefore, 6 peaks.

Question 29 ANS C

The equilibrium expression for the reaction: $4A(g) + B(g) \rightleftharpoons 2C(g) + 5D(g)$ is

$$K_c = \frac{[D]^5[C]^2}{[A]^4[B]}$$

In the numerator it is concentration to the power of 7 and in the denominator concentration to the power of 5. Hence, the equilibrium constant has units of concentration to the power of 2, M^2.

Question 30 ANS C

The balanced equation for the reaction is:

$5Fe^{2+}(aq) + MnO_4^-(aq) + 8H^+(aq) \rightarrow 5Fe^{3+}(aq) + Mn^{2+}(aq) + 4H_2O(l)$

$n(Fe^{2+})$ reacting = 5 x $n(MnO_4^-)$ reacting = 5 x c x V = 5 x 0.0500 x 0.01960

$$c(Fe^{2+}) = \frac{n}{V} = \frac{5 \times 0.0500 \times 0.01960}{0.02500} = 0.196\,\mathrm{M}$$

END OF ANSWERS
SECTION A

Section B marking: (1) in italics indicates allocation of marks for parts of each question.

Question 1 (13 marks)

a. 2-methylpropan-1-ol *(1)* , butan-2-ol *(1)* , 2-methylpropan-2-ol *(1)*

(3 x 1 = 3 marks)

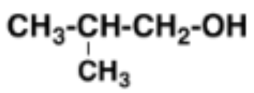
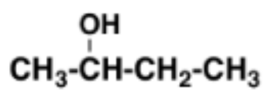
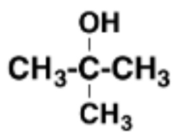
b. 2-methylpropan-2-ol is the tertiary alcohol because the –OH functional group is attached to a carbon atom that has zero hydrogen atoms attached to it.

(1 mark)

c. $CH_3CHCH_3CH_2OH$ (2-methylpropan-1-ol) has a higher boiling point *(1)* than $CH_3CH_2CH_2CH_3$ (butane) because there is polar hydrogen bonding *(1)* as well as dispersion forces between the molecules due to the presence of the –OH functional group.

(2 x 1 = 2 marks)

d. Number of peaks equals the number of unique carbon and hydrogen environments in each molecule

Compound	**Number of Peaks** ^{13}C NMR	**Number of Peaks** ^{1}H NMR
	3	4
	4	5
	2	2

(3 x 1 = 3 marks)

e. 2-methylpropan-2-ol *(1)* would not show any splitting pattern in a high resolution ^{1}H NMR spectrum because there are zero hydrogen atoms *(1)* on the adjacent carbon atom to each of the CH_3 groups.

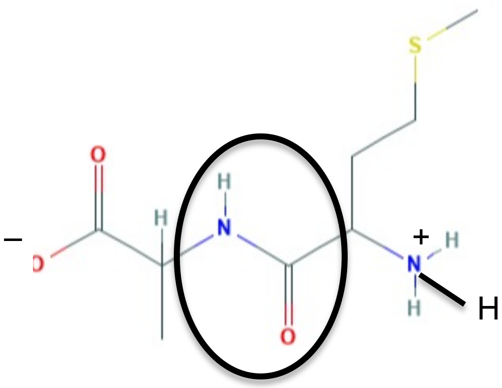
(2 x 1 = 2 marks)

f. The infra-red spectra of these three compounds would not be a suitable way of identifying them because they each contain the same functional group *(1)* and this functional group gives the same infra-red absorption range *(1)* of 3200 – 3600 cm^{-1}.

(2 x 1 = 2 marks)

Question 2 (5 marks)

a. Use the Data Book Section 17 2-amino acids. The Ala-Met zwitter ion is shown below. The alanine end has a negative charge and the methionine end has a positive charge. *(1)* The peptide link is circled. *(1)*



(2 x 1 = 2 marks)

b. This is a condensation reaction in which a water molecule is lost.

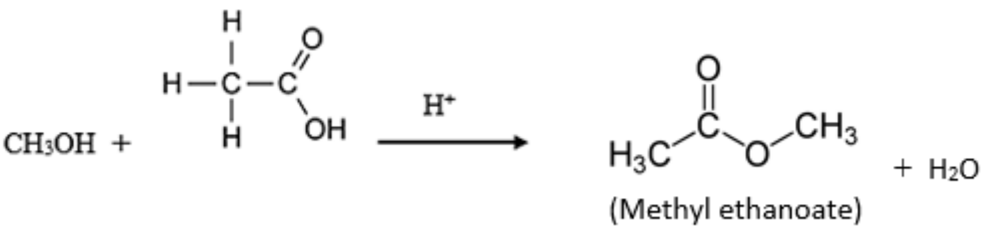
(1 mark)

c. The secondary structure of a polypeptide is caused by the pattern of hydrogen bonds *(1)* between the amino hydrogen (NH_2 groups) and carboxyl oxygen atoms (CO groups) *(1)* in the polypeptide backbone.

(2 x 1 = 2 marks)

Question 3 (10 marks)

a. To produce methyl ethanoate, the reagents methanol and ethanoic acid are needed to give the reaction shown below.



- React methane gas with chlorine gas in the presence of UV light to produce chloromethane gas and hydrogen chloride gas.
  $CH_4(g) + Cl_2(g) \rightarrow CH_3Cl(g) + HCl(g)$ *(1)*
- React chloromethane with sodium hydroxide to produce methanol.
  $CH_3Cl(g) + NaOH(aq) \rightarrow CH_3OH(aq) + NaCl(aq)$ *(1)*
- React ethene with water at 300 °C with a phosphoric acid catalyst to produce ethanol.
  $C_2H_4(g) + H_2O(g) \rightarrow C_2H_5OH(aq)$ *(1)*
- React ethanol with acidified potassium dichromate to produce ethanoic acid.
  $C_2H_5OH(aq) \rightarrow CH_3COOH(aq)$ *(1)*
- React methanol with ethanoic acid with an acid catalyst to produce methyl ethanoate.
  $CH_3OH(aq) + CH_3COOH(aq) \rightarrow CH_3COOCH_3(aq) + H_2O(l)$ *(1)*

(5 x 1 = 5 marks)

Question 3 (continued)

b. Substitution reactions: $CH_4(g) + Cl_2(g) \rightarrow CH_3Cl(g) + HCl(g)$
$CH_3Cl(g) + NaOH(aq) \rightarrow CH_3OH(aq) + NaCl(aq)$

(1 mark)

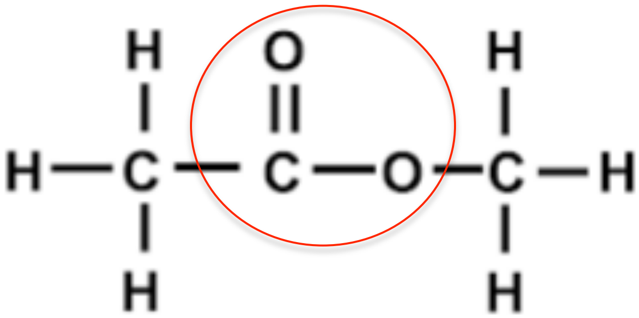
c. Addition reaction: $C_2H_4(g) + H_2O(g) \rightarrow C_2H_5OH(aq)$

(1 mark)

d. Oxidation reaction: $C_2H_5OH(aq) \rightarrow CH_3COOH(aq)$

(1 mark)

e. The structure of methyl ethanoate is shown below *(1)* The ester functional group is circled *(1)*



(2 x 1 = 2 marks)

Question 4 (7 marks)

a. Methane reacting with a limited amount of oxygen gas.

$$2CH_4(g) + 3O_2(g) \rightarrow 2CO(g) + 4H_2O(g)$$

(1 mark)

b. Reverse this equation: $Hb(aq) + 4O_2(aq) \rightleftharpoons Hb(O_2)_4(aq)$

This gives $Hb(O_2)_4(aq) \rightleftharpoons Hb(aq) + 4O_2(aq)$ *(1)*

Add this equation: $Hb(aq) + 4CO(aq) \rightleftharpoons Hb(CO)_4(aq)$

Final equation: $Hb(O_2)_4(aq) + 4CO(aq) \rightleftharpoons Hb(CO)_4(aq) + 4O_2(aq)$ *(1)*

(2 x 1 = 2 marks)

c. The equilibrium constant expression is K_c shown below. The subscript $_e$ indicates that these are the equilibrium concentrations.

$$K_c = \frac{[Hb(CO)_4]_e[O_2]_e^4}{[Hb(O_2)_4]_e[CO]_e^4}$$

(1 mark)

Question 4 (continued)

d. The concentration of $Hb(O_2)_4(aq)$ in this equilibrium could be increased by adding oxygen gas. According to Le Chatelier's Principle, this would drive the equilibrium to the left.

(1 mark)

e. There are equal numbers of molecules (five) on each side of this equation. *(1)* Hence, decreasing the volume of the solution will favour neither the forward nor the reverse reaction. *(1)*

(2 x 1 = 2 marks)

Question 5 (10 marks)

a. A balanced chemical half-equation for the production of hydrogen gas from pure water in an electrolytic cell.

$$2H_2O(l) + 2e^- \rightarrow H_2(g) + 2OH^-(aq)$$

(1 mark)

b. Hydrogen gas is produced at the cathode because this is a reduction reaction.

(1 mark)

c. Solar cells or wind would be a sustainable way to generate this electricity.

(1 mark)

d. The mass of hydrogen gas stored in 12 hours when a current of 5.5 amps flows.

$Q = I \times t = 5.5 \times 12 \times 3600$ coulombs *(1)*

From the half-equation: $n(H_2)$ produced = $0.5 \times n(e^-) = \frac{0.5\times Q}{F} = \frac{0.5\times 5.5\times 12\times 3600}{96500}$ *(1)*

Therefore, mass (H_2) produced = $\frac{0.5\times 5.5\times 12\times 3600}{96500}\times 2 = 2.46\text{g}$ *(1)*

(3 x 1 = 3 marks)

e. The overall reaction occurring in the fuel cell when it is discharging.

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

(1 mark)

f. The overall reaction occurring in the methane fuel cell when it is discharging.

$$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$$

(1 mark)

g. An advantage of methane is that it is readily available and does not need to be generated at source like hydrogen. *(1)* A disadvantage is that using it in a fuel cell produces the greenhouse gas, carbon dioxide. *(1)*

(2 x 1 = 2 marks)

Question 6 (8 marks)

a. A series of standard solutions of caffeine are prepared and analysed using HPLC to determine the peak areas of each. *(1)* A standard solution of caffeine is a solution in which the concentration is accurately known. *(1)* A calibration curve is drawn using these data and a line of best fit (if required) is placed over this calibration curve. The peak area of the unknown sample is then measured using HPLC and its concentration determined from the calibration curve. *(1)*

(3 x 1 = 3 marks)

b. From the calibration curve, the concentration of caffeine in the sample = 0.04 $\mu g\ mL^{-1}$. *(1)*
= 0.04 x 10^{-6} g mL^{-1}
= 0.04 x 10^{-6} x 10^{3} g L^{-1} *(1)*
= 0.04 x 10^{-3} g L^{-1}
= 4.0 x 10^{-5} g L^{-1} *(1)*

(3 x 1 = 3 marks)

c. Mass of caffeine in 25 mL = 4.0 x 10^{-5} x (25/1000) *(1)*
Molar mass of caffeine = (8 x 12) + (10 x 1) + (4 x 14) + (2 x 16) = 194 g mol^{-1}.

Number of mol of caffeine in 25 mL = $\frac{4.0\times10^{-5}\times25}{1000\times194}=5.2\times10^{-9}\text{ mol}$ *(1)*

(2 x 1 = 2 marks)

Question 7 (6 marks)

a. Use the Data Book Section 13 – Energy content of food groups. Water and fibre do not provide any energy. Amounts given are per 100 g so we must multiply by 125/100.

Energy content of a 125 g banana
= (1.2 x 125/100) x 17 + (18.8 x 125/100) x 16 + (0.2 x 125/100) x 37 *(1)*
= 25.5 + 376 + 9.25
= 410.8 kJ *(1)*

(2 x 1 = 2 marks)

b. Use the Data Book Section 11 – Heats of combustion of common fuels.
Heat of combustion of butane = 49.7 kJ g^{-1}. *(1)*

Energy released by the butane = 0.215 x 49.7 kJ *(1)*
This produced a temperature rise of 4.25 ^{o}C.

Energy required to give a temperature rise of 2.55 ^{o}C = $\frac{0.215\times49.7\times2.55}{4.25}\text{ kJ}$ *(1)*

This energy was produced by 2.100 g of banana.

Energy produced by 125 g of banana = $\frac{0.215\times49.7\times2.55}{4.25}\times\frac{125}{2.100}=381.6\text{ kJ}$ *(1)*

(4 x 1 = 4 marks)

Question 8 (20 marks)

a. The two main variables to be controlled are the concentration *(1)* of the aqueous solutions and the temperature. *(1)*

(2 x 1 = 2 marks)

b. Use the Data Book Section 2 – Electrochemical series to complete the table. The anode is the electrode at which oxidation occurs. The predicted cell voltage is the difference between the E^0 values of the respective half-cells. The electron flow is from the anode to the cathode.

(1) for each line completely correct.

Half-cell A	Half-cell B	Anode (X or Y)	Predicted cell voltage (V)	Expected direction of electron flow in the external circuit (A to B or B to A)
Cu^{2+}(aq)/Cu(s)	Fe^{2+}(aq)/ Fe(s)	Fe **(Y)**	0.78	B to A
Cu^{2+}(aq)/Cu(s)	Zn^{2+}(aq)/Zn(s)	Zn **(Y)**	1.10	B to A
Cu^{2+}(aq)/Cu(s)	Fe^{3+}(aq)/Fe^{2+}(aq)	Cu **(X)**	0.43	A to B
Fe^{2+}(aq)/Fe(s)	Zn^{2+}(aq)/Zn(s)	Zn **(Y)**	0.32	B to A
Fe^{2+}(aq)/Fe(s)	Fe^{3+}(aq)/Fe^{2+}(aq)	Fe **(X)**	1.21	A to B
Zn^{2+}(aq)/Zn(s)	Fe^{3+}(aq)/Fe^{2+}(aq)	Zn **(X)**	1.53	A to B

(6 x 1 = 6 marks)

c. **i.** Fe(s) + Cu^{2+}(aq) $\rightarrow$ Cu(s) + Fe^{2+}(aq)

(1 mark)

ii. Zn(s) + Fe^{2+}(aq) $\rightarrow$ Fe(s) + Zn^{2+}(aq)

(1 mark)

d. Salt water contains positive and negative ions in aqueous solution. *(1)* These ions carry the electric charge between metals and allow a circuit to form. An oxidation reaction (corrosion) can then occur on the surface of the iron. *(1)*

(2 x 1 = 2 marks)

e. Steel is made from iron. Iron metal is a stronger reducing agent than copper metal. *(1)* That is, iron gives up its electrons more easily than copper. Hence, when these two metals are connected, the corrosion of iron proceeds more quickly. *(1)*

(2 x 1 = 2 marks)

f. In the experiment, when iron metal was connected to zinc metal, the electrons flowed from zinc to iron. *(1)* Hence, by connecting zinc metal to iron metal, the zinc will be oxidised in preference to the iron in the process known as sacrificial protection. *(1)*

(2 x 1 = 2 marks)

g. Na(s) is a very strong reducing agent *(1)* but it is not suitable for this experimental investigation since sodium metal will react directly with the aqueous Na^+ solution to produce hydrogen gas. *(1)*

(2 x 1 = 2 marks)

h. Any half-cell that extends the E^0 range *(1)* for the experimental investigation but is not compromised like the Na^+(aq) / Na(s) half-cell**.** For example, Ag^+(aq) / Ag(s). *(1)*

(2 x 1 = 2 marks)

Question 9 (7 marks)

a. Glycerol reacts with fatty acids to form triglycerides.

(1 mark)

b. The monounsaturated fatty acid is the one with the carbon- carbon double bond. It is $C_{17}H_{33}COOH$. From the Data Book Section 9 – formulas of some fatty acids, it is oleic acid.

(1 mark)

c. To write the molecular formula for this triglyceride, notice that there is a carbon atom where lines meet and at the ends each carbon atom must have the number of hydrogen atoms to make a total of 4 bonds.
Carbon: 3 + 14 + 16 + 18 = C_{51} Hydrogen: 5 + 27 + 31 + 33 = H_{96} Oxygen: O_6
The molecular formula is $C_{51}H_{96}O_6$

(1 mark)

d. Methanol (CH_3OH) is used to produce biodiesel from triglycerides.

(1 mark)

e. Potassium hydroxide (KOH) is used to catalyse the production of biodiesel from triglycerides.

(1 mark)

f. Biodiesel molecules produced from plant oils often contain carbon-carbon double bonds. *(1)* This gives a kink in the molecules and makes it more difficult for them to pack closely together. Hence, the dispersion forces between these molecules are weaker and more easily overcome. *(1)* Therefore, they have lower melting points than biodiesel molecules produced from saturated fats obtained from animals.

(2 x 1 = 2 marks)

Question 10 (4 marks)

The balanced equation for the reaction is: $2C_{17}H_{34}O_2(l) + 49O_2(g) \rightarrow 34CO_2(g) + 34H_2O(g)$ *(1)*

$n(CO_2)$ produced = 17 x $n(C_{17}H_{34}O_2)$ reacting = $17 \times \frac{m}{M} = \frac{17 \times 1000}{270}$ *(1)*

$V(CO_2)$ produced = $n(CO_2)$ produced x 24.8 L mol^{-1} (Data Book Section 4) *(1)*

$$= \frac{17 \times 1000}{270} \times 24.8 = 1561 \text{ L}$$ *(1)*

End of 2020 Kilbaha VCE Chemistry Trial Examination 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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