



The Victorian
Institute of
Learning

VCE Unit 3 & 4 Chemistry

Trial Examination 2019

Suggested Solutions

Section A Multiple Choice

Qn	Answer	Qn	Answer
1	B	16	B
2	C	17	C
3	A Electrode polarity reversed in electrolytic cells	18	A $n(\text{KMnO}_4) = 0.01 \times 0.00432 = 0.0000432$ $n(\text{Fe}^{2+}) = 0.0000432 \times 5 = 0.000216$ $C(\text{Fe}^{2+}) = 0.000216/0.020 = 1.08 \times 10^{-2}$
4	C	19	C
5	A	20	C
6	D	21	D
7	A $n(\text{prop}) = 12.8/44 = 0.291$ $m(\text{CO}_2) = 44 \times 0.873 = 38.4 \text{ g}$ $m(\text{H}_2\text{O}) = 18 \times 1.164 = 21.0 \text{ g}$ $m(\text{GHG}) = 38.4 + 21.0 = 59.4 \text{ g}$	22	B Must mention successful collisions
8	A	23	C $n(\text{cyclohex}) = 15000/3920 = 3.8$ $m(\text{cyclohex}) = 3.8 \times 84 = 0.319 \text{ kg}$ Closest to C
9	C $0.80 - -0.13 = +0.93$	24	B
10	B $n(\text{glu}) = 115/180 = 0.639$ $n(\text{CO}_2) = 6 \times 0.639 = 3.83$ $V = 3.83 \times 24.8 = 95.07 \text{ L}$	25	C
11	C	26	D
12	D	27	A $M = (453 \times 180) - (452 \times 18) = 73404 \text{ g/mol}$
13	A	28	D
14	A $2 \times -628 + 92 = -1164 \text{ Kj}$	29	A
15	A	30	C There are many other types of bonds involved in tertiary structure

Short Answer

Question 1

- a) Any of
- They have lower carbon emissions
 - The fuel last for a longer period of time
 - The fuel is more readily available
 - Any other appropriate answer
- b)
- Anode: $\text{CH}_3\text{OH}_{(\text{aq})} + 2\text{H}_2\text{O}_{(\text{l})} \rightarrow \text{CO}_{2(\text{g})} + 6\text{H}^+_{(\text{aq})} + 6\text{e}^-$
Cathode: $\text{O}_{2(\text{g})} + 4\text{H}^+_{(\text{aq})} + 4\text{e}^- \rightarrow 2\text{H}_2\text{O}_{(\text{l})}$
- c)
- i. Negative
ii. \longrightarrow
- d) $2 \text{C}_{12}\text{H}_{26} (\text{l}) + 37 \text{O}_2 (\text{g}) \rightarrow 24 \text{CO}_2 (\text{g}) + 26 \text{H}_2\text{O} (\text{g})$
1 mark for states and **1 mark** for correctly balanced
- e) $V(\text{diesel}) = 450 \times 2 = 900 \text{ L}$ (**1 mark**)
 $m(\text{diesel}) = 900\,000 \times 0.832 = 748\,800 \text{ g}$ (**1 mark**)
 $E = 748\,800 \times 45.0 = 33\,696\,000 \text{ kJ} = 33.7 \text{ GJ}$ (**1 mark**)

Question 2

- a) Energy calculations
 $E(\text{p}) = 1500 \times 47.9 = 71\,850 \text{ kJ}$ $E(\text{H}) = 1500 \times 141 = 211\,500 \text{ kJ}$ $E(\text{eth}) = 1500 \times 29.6 = 44\,400 \text{ kJ}$
1 mark each and **1 mark** for stating Hydrogen would release the most energy
- b) The combustion of hydrogen gas releases less greenhouse gases (**1 mark**) as only water vapour is release and no carbon dioxide is release (**1 mark**)
- c) Hydrogen would be suitable for the rocket (**1 mark**) as it is energy dense meaning it wouldn't weigh as much as other fuels for take-off. (**1 mark**)
Petrol is the best for the generator (**1 mark**) as it still produces a good amount of energy per gram but is less flammable and much easier to store and transport. (**1 mark**)

Question 3

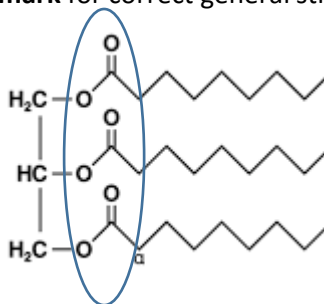
- a) By separating the redox reaction into two half cells the electrons must travel along the connecting wires to complete the reaction. (**1 mark**) The salt bridge also connects the internal circuit allowing the flow of charge through the circuit continuously. (**1 mark**)
- b) The iron half cell as both redox conjugate pairs are aqueous solutions. (**1 mark**) You could use a graphite or platinum electrode as they are inert and won't react as part of the cell (**1 mark**)
- c) Cells 1 and 2 or Zn and Ag
- d) Silver will deposit on the silver electrode (**1 mark**)
The zinc electrode will crumble/deteriorate (**1 mark**)

Question 4

- a) The addition of $\text{Ca}(\text{OCl})_2$ would result in the production of more OCl^- when it dissolves. **(1 mark)** This would then react with H_3O^+ ions in the water to produce more HOCl . **(1 mark)** As H_3O^+ is being consumed the $[\text{H}_3\text{O}^+]$ will decrease causing the pH to increase. **(1 mark)**
- b) 8.2 is too high meaning there isn't enough H_3O^+ ions in the water. **(1 mark)** By adding more water to the pool the back reaction would be favoured producing more H_3O^+ . **(1 mark)** This would bring the pH down into the optimum range for the pool. **(1 mark)**

Question 5

- a)
- i. D
 - ii. C & H
 - iii. B
 - iv. F
 - v. E
 - vi. D or I
- b) **1 mark** for correct general structure and **1 mark** for correct ester groups as shown below



Question 6

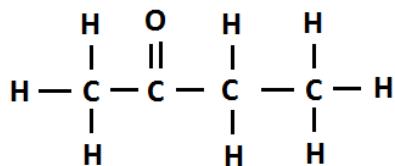
a)

Haloalkane	
$ \begin{array}{cccccc} & \text{H} & \text{Cl} & \text{H} & \text{H} & \text{H} \\ & & & & & \\ \text{H} & - \text{C} & - \text{C} & - \text{C} & - \text{C} & - \text{C} - \text{H} \\ & & & & & \\ & \text{H} & \text{H} & \text{H} & \text{H} & \text{H} \end{array} $ <p style="text-align: right;">1 mark</p>	<p>Name: 2-Chloropentane</p> <p>1 mark</p>
Aldehyde	
$ \begin{array}{cccccc} & \text{H} & \text{H} & \text{H} & \text{H} & \text{O} \\ & & & & & // \\ \text{H} & - \text{C} & - \text{C} & - \text{C} & - \text{C} & - \text{C} \\ & & & & & \\ & \text{H} & \text{H} & \text{H} & \text{H} & \text{H} \end{array} $ <p style="text-align: right;">1 mark</p>	<p>Name: Pentanal</p> <p>1 mark</p>

All bonds must be shown to award marks for structure

b)

i. $\text{CH}_2\text{CHCH}_2\text{CH}_3$



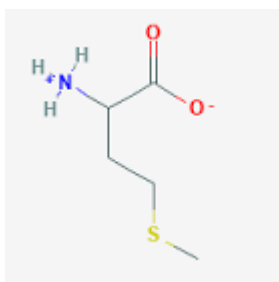
ii.

iii. Compound Y = Butan-2-one Compound Z = Propyl Butanoate

iv. Either MnO_4^{2-} and H^+ or $\text{Cr}_2\text{O}_7^{2-}$ and H^+

Question 7

- a) Disulfide bridge
- b) Disulfide bridges are covalent bonds where all other bonds that hold tertiary structure together are much weaker intermolecular forces. **1 mark** These covalent bonds are much more difficult to break so the protein can maintain its 3D shape over a greater range of temperatures and pHs. **1 mark**
- c)



- d) Enzyme catalysed hydrolysis
- e) The coenzyme activates the enzyme allowing it to catalyse a chemical reaction. **1 mark** The coenzyme bonds to the surface of active site of the enzyme changing the active site shape enabling it to receive the substrate. **1 mark** The coenzyme can also act as a carrier of electrons or other functional groups. **1 mark**

Question 8

- a) $\text{C}_4\text{H}_8\text{O}$
- b) They are positional not chain isomers as they have the same parent chain (C4) but the position of the functional group (C=O) is different
- c) C=O peak present at 1750 present on IR spectra **1 mark** and explanation of the splitting patterns on ¹H NMR **1 mark** indicate that sample A is butanal **1 mark**

Question 9

- a)
- $Q = 25.0 \times (15 \times 60) = 22500$ **1 mark**
 $n(e^-) = Q/F = 22500/96500 = 0.233$ **1 mark**
 $n(\text{Sn}) = 0.5 \times 0.233 = 0.117$
 $m(\text{Sn}) = 0.117 \times 118.7 = 13.8 \text{ g}$ **1 mark**
- b) The chromium solution would deposit the least amount of metal **1 mark** as it is a 3+ ion meaning each atom of chromium requires three electrons to deposit. **1 mark**
- c) The electroplating cell should have deposited 13.8 g of Sn but the results show that only 10.9 g was deposited. **1 mark** This could be due to the current being produced by the power supply being lower than recorded. **1 mark** Accept other reasonable explanations for a lower experimental result
- d) **Magnesium is lower on the electrochemical series than water meaning it is a weaker oxidant than water. 1 mark** As the magnesium would be in solution where water is present hydrogen would be produced at the cathode instead of the desired magnesium metal. **1 mark**

Question 10

- a) As it mentions potatoes are starchy in the question iodine indicator should be used **1 mark**
IV = surface area of potatoes **1 mark**
DV = The time for iodine to change colour **1 mark**
Controlled variables: must mention at least 2 of: **1 mark**
- Amount of indicator
 - Amount of potato
 - Amount of amylase
 - Temperature of reaction
 - Any other appropriate response
- b) Systematic errors:
- Using contaminated or the wrong indicator
 - Any error related to \pm ranges or calibration of instruments
 - Any other appropriate response
- Random errors:
- Small differences in masses or volume related to transferring substances
 - Contamination of a single sample
 - Any other appropriate response

Award **1 mark** for 1 systematic error and **1 mark** for 1 random error

Impact responses:

- Accuracy refers to how close to the true value the result is
- Precision refers to certainty of values obtained Eg more decimal points means more precise
- Reliability refers to the repeatability of the experiment

Award **1 mark** for each correct explanation of impact for the errors identified

- c) Glycaemic index is the measure of how quickly the body can breakdown carbohydrates to release glucose into the blood. **1 mark** Increasing the surface area would allow for this process to happen much quicker as the enzymes have greater access to the starch in the potato. **1 mark** The potato with increased surface area would have an increased GI value as glucose would be released into the blood much faster. **1 mark**

Question 11

- a) Chiral molecules contain a chiral centre, which is a carbon bonded to 4 different groups. This gives it a unique structure and cannot be superimposed on its mirror image.
- b) **1 mark** is awarded for mentioning each of the following points
- Enzymes have specific shaped active sites of which only complementary shaped substrates can bind
 - The active site of the enzyme is formed by its tertiary structure
 - The substrate binds to the active site via intermolecular forces between its functional groups and those of the side chains of the amino acids exposed at the active site
 - Optical isomers have the same functional groups but a different arrangement in space
 - If the functional groups of the substrate don't match the exact shape of the active site, such as an optical isomer, then the enzyme is unable to function

c)

