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(KMnO4)= 0.01 x 0.00432 = 0.0000432 n(Fe2+)= 0.0000432 x 5 = 0.000216 C(Fe2+) = 0.000216/0.020 = 1.08 x 10-2
4	C	19	C
5	A	20	C
6	D	21	D
7	A n(prop)= 12.8/44 = 0.291 m(CO2)= 44 x 0.873=38.4 g m(H2O)= 18 x 1.164 = 21.0 g m(GHG)= 38.4 + 21.0 = 59.4 g	22	B Must mention successful collisions
8	A	23	C n(cyclohex)= 15000/3920 = 3.8 m(cyclohex)= 3.8 x 84 = 0.319 kg Closest to C
9	C 0.80 - -0.13 = +0.93	24	B
10	B n(glu)= 115/180=0.639 n(CO2)=6 x 0.639 = 3.83 V= 3.83 x 24.8 = 95.07 L	25	C
11	C	26	D
12	D	27	A M= (453 x 180) – (452 x 18) = 73404 g/mol
13	A	28	D
14	A 2 x -628 + 92 = -1164 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: $CH_3OH_{(aq)} + 2H_2O_{(l)} \rightarrow CO_{2(g)} + 6H^+_{(aq)} + 6e^-$
Cathode: $O_{2(g)} + 4H^+_{(aq)} + 4e^- \rightarrow 2H_2O_{(l)}$

c)
i. Negative
ii. ⟶

d) $2\ C_{12}H_{26\ (l)} + 37\ O_{2\ (g)} \rightarrow 24\ CO_{2\ (g)} + 26\ H_2O_{\ (g)}$
1 mark for states and **1 mark** for correctly balanced

e) V(diesel) = 450 x 2 = 900 L **(1 mark)**
m(diesel) = 900 000 x 0.832 = 748800 g **(1 mark)**
E = 748800 x 45.0 = 33 696 000 kJ = 33.7 GJ **(1 mark)**

Question 2

a) Energy calculations
E(p) = 1500 x 47.9 = 71850 kJ E(H) = 1500 x 141 = 211500 kJ E(eth) = 1500 x 29.6 = 44400 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 $Ca(OCl)_2$ 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 $[H_3O^+]$ will decrease causing the pH to increase. **(1 mark)**

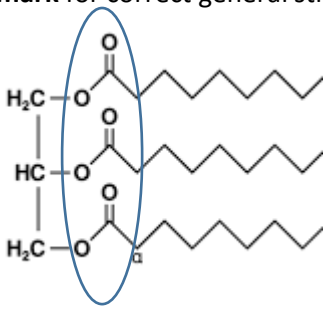
b) 8.2 is too high meaning there isn't enough H_3O^+ ions in the water. **(1 mark)** By adding more water to the pool the back reaction would be favoured producing more H_3O^+. **(1 mark)** This would bring the pH down into the optimum range for the pool. **(1 mark)**

Question 5

a)

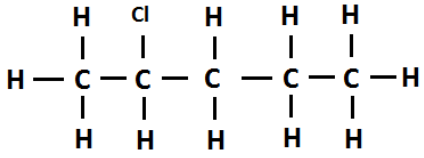
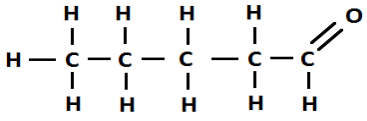
i. D
ii. C & H
iii. B
iv. F
v. E
vi. D or I

b) **1 mark** for correct general structure and **1 mark** for correct ester groups as shown below



Question 6

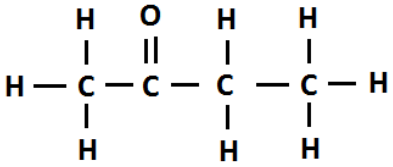
a)

Haloalkane	
 **1 mark**	Name: 2-Chloropentane **1 mark**
Aldehyde	
 **1 mark**	Name: Pentanal **1 mark**

All bonds must be shown to award marks for structure

b)

i. $CH_2CHCH_2CH_3$



ii.

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

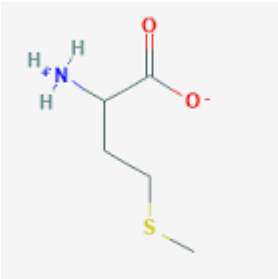
iv. Either MnO_4^{2-} and H^+ or $Cr_2O_7^{2-}$ and H^+

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 is 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 or electrons or other functional groups. **1 mark**

Question 8

a) C_4H_8O

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 HNMR **1 mark** indicate that sample A is butanal **1 mark**

Question 9

a)
Q= 25.0 x (15 x 60) = 22500 **1 mark**
n(e-) = Q/F = 22500/96500 = 0.233 **1 mark**
n(Sn) = 0.5 x 0.233 = 0.117
m(Sn) = 0.117 x 118.7 = 13.8 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 ± 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)