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BIOLOGY
Unit 4
Trial Examination

SOLUTIONS BOOK

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Phone: 61 + 3 9385 3999 • Fax: 61 + 3 9386 6722 • Email: stav@stav.vic.edu.au Website: http://www.stav.vic.edu.au

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SEMESTER 2

Use this page as an overlay for marking the multiple choice answer sheets. Simply photocopy the page onto an overhead projector sheet. The correct answers are open boxes below. Students should have marked their answers with a cross. Therefore, any open box with a cross inside it is correct and scores 1 mark.

1.	A	B		D
2.	A	B	C	
3.	A		C	D
4.	A		C	D
5.		B	C	D
6.	A		C	D
7.		B	C	D
8.	A	B	C	
9.	A	B	C	
10.	A		C	D

11.	A	B		D
12.		B	C	D
13.	A	B	C	
14.		B	C	D
15.	A	B		D
16.	A	B	C	
17.	A	B		D
18.	A		C	D
19.	A	B		D
20.		B	C	D

SECTION A

1.	C	**2.**	D	**3.**	B	**4.**	B	**5.**	A
6.	B	**7.**	A	**8.**	D	**9.**	D	**10.**	B
11.	C	**12.**	A	**13.**	D	**14.**	A	**15.**	C
16.	D	**17.**	C	**18.**	B	**19.**	C	**20.**	A

SECTION B

Question 1

a. The second shell contains only two subshells: the *2s* and *2p* subshells. A *2d* subshell does not exist. 1 mark

b. Elements are not arranged according to their relative atomic masses but rather according to their atomic numbers. Although nickel has a lower relative atomic mass it has the higher atomic number. 1 mark
[The most abundant isotope of cobalt has a greater isotopic mass than that of nickel. However nickel has the greater number of protons – hence the higher atomic number.]

c. The species O^- has gained an electron resulting in greater electron-electron repulsion causing the radius to increase (relative to that of the oxygen atom). The species has lost an electron reducing electron-electron repulsion. 1 mark
[Note the core charge is unchanged.]

d. Triglycerides provide the most energy per gram (compared to proteins and carbohydrates) and are therefore the most efficient means of storing energy. 1 mark

e. Vitamin C is water soluble (due to the presence of the hydroxyl groups) and is therefore not suitable to be used as an antioxidant for unsaturated fats and oils. 1 mark

f. The use of the standard electrode potentials is used to predict the extent of reactions under standard conditions. Factors such as a slow rate of a reaction can result in predicted reactions not being observed. 1 mark

g. The calibration factor for a solution calorimeter containing 100 mL of water would be greater than 418 J $^oC^{-1}$. This is the energy absorbed by the water alone. 1 mark

Question 2

a. $C_6H_{12}O_6(aq) \rightarrow 2C_2H_5OH(aq) + 2CO_2(g)$ 1 mark

b. (i) $C_6H_{12}O_6(aq) + 6H_2O(l) \rightarrow 6CO_2(g) + 24H^+(aq) + 24\ e^-$ 1 mark

(ii) $C_6H_{12}O_6(aq) + 12H^+(aq) + 12\ e^- \rightarrow 3C_2H_5OH(aq) + 3H_2O(l)$ 1 mark

c. (i) $\Delta T = 30.5 - 20.0 = 10.5\ ^oC$ 1 mark

$\Delta E = mc\Delta T = 100\ (kg) \times 4.18 \times 10.5 = 4389\ kJ = 4.39\ MJ$ 1 mark

(ii) M (glucose) = 6 x 12.0 + 12 x 1.0 + 6 x 16.0 = 180.0 g mol^{-1} 1 mark

n (glucose) = m/ M = 11.5 x 1000 / 180.0 = 63.89 mol 1 mark

Therefore 63.89 mol releases 4389 kJ

Hence 1 mol releases 4389/ 63.89 = 68.70 kJ

Therefore ΔH = - 68.7 kJ mol^{-1} 1 mark

[One mark should be deducted if less than two or more than four significant figures are used in parts c.(i) or c.(ii)]

Question 3

a. Iron electrode (is the site of reduction). 1 mark

b.

Iron	**$2H^+(l) + 2e^- \rightarrow H_2(g)$** (*or* $2HF(l) + 2e^- \rightarrow H_2(g) + 2F^-(l)$	1 mark
Carbon	**$2F^-(l) \rightarrow F_2(g) + 2e^-$** (*or* $2HF(l) \rightarrow F_2(g) + 2H^+(l) + 2e^-$)	1 mark

[Deduct one mark for incorrect states. Especially look out for the incorrect use of (aq) for the reactants.]

c. The fluoride ion is a weaker reductant than water. Therefore water would be oxidised in preference producing O_2 and H^+ according to the equation: 1 mark

$2H_2O(l) \rightarrow O_2(g) + 4H^+(aq) + 4e^-$. 1 mark

[Alternatively; could give: $2H_2O(l) \rightarrow O_2(g) + 2H_2$, for 1 mark]

d. Iron is a stronger reductant than the fluoride ion (and would be oxidised in preference). Carbon is inert. 1 mark

[It is not adequate to say that (any) F_2 formed would react with the iron electrode as little fluorine gas would be produced.]

Question 3 ***continued***

e. (i) $Q = It = 10.5 \times 10 \times 60 = 6300$ C (6.3×10^3 C) 1 mark

$n_{electron} = \frac{Q}{F} = \frac{6300}{96500} = 0.06528$ mol (assuming 100% efficiency) 1 mark

Amount of electrons discharging fluorine gas is $n_{electron}$ (used).

Therefore: $n_{electron}$ (used) is 90% of 0.06528 = 0.05876 mol 1 mark

$n_{fluorine\ gas} = ½\ n_{electron}$ (used) = ½ x 0.05876 = 0.029 mol 1 mark

(ii) $V_{fluorine\ gas} = n \times V_m = 0.02938 \times 24.5 = 0.72$ L 1 mark

f. Fluorine has a very high electronegativity. 1 mark
That is, it has a high tendency to gain electrons and cause other species to lose them and be oxidised. 1 mark

Question 4

i)	starch	**A and D**
ii)	a disaccharide	**D (only)**
iii)	saturated fat	**C and E**

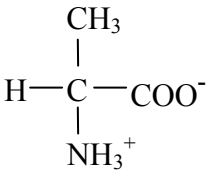
2 marks; 1 mark; 2 marks

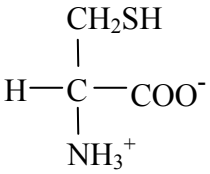
Question 5

a. Five 1 mark

b. (i) Hydrolysis 1 mark

(ii) *For example*

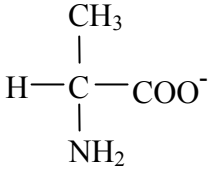




Structures 1 mark each
Total = 2 marks

Alanine 1 mark

(iii) *For example (using alanine)*

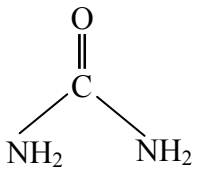


1 mark

Question 5 ***continued***

c. The ions formed will migrate towards the **CATHODE**.
At pH 2 lysine will retain both H atoms on the carboxyl groups and have a protonated amino group. Therefore the ion formed from lysine will be positively charged. Positive ions (always) migrate towards the cathode. 1 mark
1 mark

d. (i) Urea



1 mark each
Total = 2 marks

(ii) The enzyme has been **denatured**. 1 mark

Denaturation can also be brought about by **heat**. 1 mark

Question 6

a. (i) $1s^2 2s^1$ (ii) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^2 4s^2$ 1 mark each
(Must use *s, p, d* notation for marks) Total = 2 marks

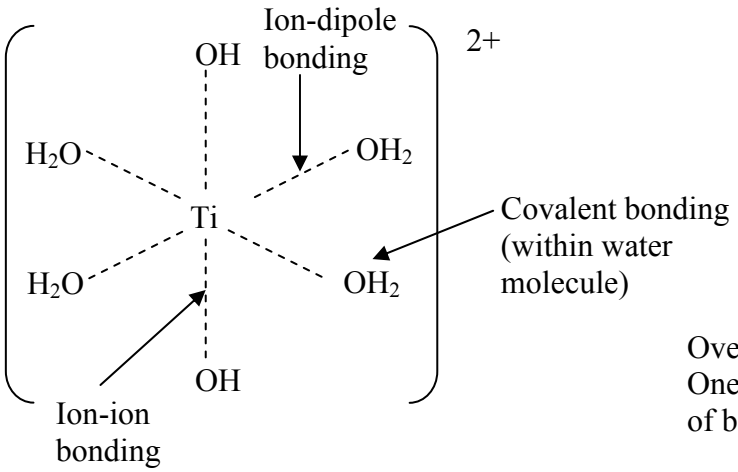
b. Titanium is a transition element while lithium is a main group element. 1 mark

Due to the incomplete 3d subshell in transition elements there are a greater number of electrons available to be delocalised resulting in stronger metallic bonding. 1 mark

c. (i) A complex ion consists of a cation bonded to a number of ligands (eg polar molecules or anions). 1 mark

(ii) Titanium has a 4+ charge. 1 mark

(iii) *For example*



Overall structure 1 mark
One mark for each type of bonding labelled
= 3 marks
Total = 4 marks

[The charges can be shown on the central cation and on the hydroxide ions.]

END OF SUGGESTED SOLUTIONS