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Beaulieu College – Physical Science Grade 12 Chemistry

Question 1

- 1.1 D ✓✓
 1.2 B ✓✓
 1.3 A ✓✓
 1.4 D ✓✓
 1.5 C ✓✓
 1.6 A ✓✓
 1.7 A ✓✓
 1.8 C ✓✓
 1.9 B ✓✓
 1.10 A ✓✓

$$10 \times 2 = 20$$

Question 2

2.1. Intramolecular bond is a bond which occurs between ✓ atoms within ✓ molecules. (2)

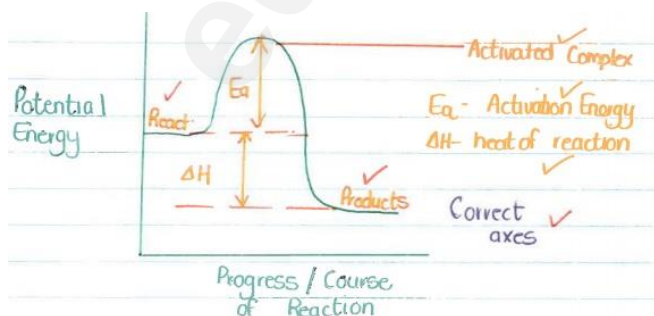
2.2. metallic ✓ (1)

2.3. Arises from the electrostatic attractive force between delocalised electrons ✓ and positive ✓ atomic kernels. (2)

2.4. $\cdot \ddot{\text{Ga}} \cdot$ ✓✓ (2)

2.5.1. $4 \text{ Ga} + 3 \text{ O}_2 \rightarrow 2 \text{ Ga}_2\text{O}_3$ (3)
 ✓ O_2
 ✓ Ga_2O_3
 ✓ Balancing

2.5.2.



(6)

2.6. A measure of the tendency of an atom ✓ to attract a bonding pair of electrons ✓. (2)

2.7. a) $\text{NH}_3 = 0.9$ $\text{CF}_4 = 1.5$ CF_4 ✓ (1)

b) CF_4 has an END = 1.5 and NH_3 0.9 ✓
 CF_4 is more polar because of the higher end difference ✓ OR F is very electronegative ✓ OR greater pull on e's ✓ (2)

Question 3

3.1. Change in the concentration ✓ per unit time ✓ of either the reactant or the product. (2)

3.2.1. Temperature ✓ (1)

3.2.2. Volume of gas formed per unit time ✓ OR rate at which gas forms. ✓ (1)

3.3. Exp⁴ has a larger mass of CaCO_3 ∴ greater surface area. ✓
 More effective/ successful collisions per unit time. ✓
 ∴ rate is higher ✓. (3)

3.4.1. C ✓ (1)

3.4.2. a) 2 has a lower concentration ✓ than 1
 ∴ slower rate and less steep gradient ✓. (2)

b) 3 has a higher temperature ✓
 ∴ slower rate and less steep gradient ✓ (2)

3.4.3. a) $n = \frac{V}{Vm} \checkmark = \frac{4.2}{24.4} \checkmark = 0.17 \text{ mol} \checkmark$ (3)

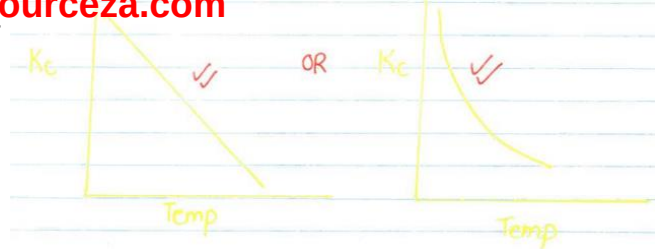
b) Ratio $\text{CO}_2 : \text{CaCO}_3$
 $1 : 1 \therefore n(\text{CaCO}_3) = 0.17 \text{ mol} \checkmark$
 $n = \frac{m}{M}$
 $m = nM$
 $m = 0.17 \times 100 \checkmark = 0.17 \text{ g} \checkmark$

3.4.4. $\% \text{ purity} = \frac{\text{pure mass}}{\text{impure mass}} \checkmark \times \frac{100}{1}$
 $= \frac{17.21}{25} \checkmark \times \frac{100}{1}$
 $= 68.84\% \checkmark$ (3)

Question 4

- 4.1.1. Reaction is reversible ✓ (1)
- 4.1.2. One in which mass ✓ is conserved inside the system but energy can ✓ enter or leave the system freely. (2)
- 4.1.3. The minimum ✓ energy required to start a chemical reaction ✓ OR the energy needed to form the activated complex ✓✓. (2)
- 4.1.4. Correct orientation ✓
Sufficient energy E_k equal to or $> \epsilon_a$ ✓
- 4.1.5. Concentration of P remains constant. ✓✓
- 4.1.6. Yes ✓
- 4.1.7. Answer sheet
- 4.1.8. Answer sheet
- 4.2. $2XY(g) \rightleftharpoons X_2 + Y_2$
- | | 2XY | X_2 | + | Y_2 |
|---|-----------------|-----------------|---|-----------------|
| I | 1,2 | 0 | | 0 |
| R | 1,0 ✓ | 0,5 | | 0,5 |
| E | 0,2 | 0,5 | | 0,5 ✓ |
| C | $\frac{0,2}{2}$ | $\frac{0,5}{2}$ | | $\frac{0,5}{2}$ |
| | 0,1 | 0,25 | | 0,25 ✓ |
- $$K_c = \frac{[X_2][Y_2]}{[XY]^2}$$
- $$= \frac{(0,25)(0,25)}{0,1^2} \checkmark$$
- $$= 6,25 \checkmark$$
- b) $K_c > 1$ ✓ Yield is good ✓ or more products than reactants ✓
- 4.3.1. When an external stress (change in P, T or C) is applied to a system in dynamic equilibrium, the equilibrium point will change in such a way to counteract the stress ✓✓ (all or nothing).
- 4.3.2. – cooled so exothermic reaction is favoured ✓
– Forward reaction is favoured ✓
– A_2 is used up hence a lighter yellow colour ✓
 ΔH will be negative or < 0 ✓

4.3.3.

**Question 5**

- 5.1.1. An acid is a proton ✓ donor ✓.
- 5.1.2. $H_2O \checkmark + HSO_4^- \checkmark$
- 5.2.1. $HY \checkmark$
- 5.2.2. $HX \checkmark$
- 5.2.3. $H_2X \checkmark$
- 5.2.4. $HY \checkmark \checkmark$
- 5.2.5. $HX \checkmark \checkmark$
- 5.3.1. Splitting of an ionic compound into its ions ✓✓.
- 5.3.2. $NaOH(s) \rightarrow Na^+(aq) + OH^-(aq)$
- 5.3.3. $c = \frac{m}{M_v}$
 $m = cM_v$
 $= 0,1(23+16+1 \checkmark)(0,2 \checkmark) = 0,8g \checkmark$
- 5.3.4. $[OH^-] = \checkmark [NaOH] = 0,1 mol \cdot dm^{-3} \checkmark$
- 5.3.5. $[OH^-][H_3O^+] = 1 \times 10^{-14}$
 $[H_3O^+] = \frac{1 \times 10^{-14}}{0,1}$
 $= 1 \times 10^{-13} mol \cdot dm^{-3}$

Question 6

- 6.1. chemical potential ✓ $\rightarrow$ electrical energy ✓
- 6.2. Platinum ✓
- 6.3. $E^\circ_{cell} = E^\circ_{cathode} - E^\circ_{anode} \checkmark$
 $= 0,15 - (-0,28) \checkmark$
 $= 0,43V \checkmark$
- 6.4. * completes the circuit ✓
* keeps electrolytes neutral ✓ or
* maintains neutrality

6.5. $\text{Co(s)} / \text{Co}^{2+}(\text{aq}) // \text{Sn}^{4+}(\text{aq}) / \text{Sn}^{2+}(\text{aq}) / \text{Pt}$

Anode✓

Cathode✓

Salt bridge✓

Pt✓ Pt on right side ✓

6.6.1. $\text{Co} \rightarrow \text{Co}^{2+} + 2\text{e}^-$ ✓✓

6.6.2. Decrease ✓

6.6.3. $n = \frac{m}{M} = \frac{7,25}{59+2(35,5)} = \frac{7,25}{59} \checkmark = 0,12\text{mol} \checkmark$

6.6.4. $N_{\text{Co}} : n_{\text{e}}$

1 : 2✓

0,12: 0,24✓

$$n = \frac{q}{F}$$

$$q = nF = 0,24 \times 96500 \checkmark$$

$$= 23160\text{C} \checkmark$$

$$q = It \checkmark$$

$$t = \frac{q}{I}$$

$$= \frac{23160}{3,56}$$

$$= 6505,62\text{s} \checkmark$$

Question 7

7.1. electrolytic✓

7.2. Electrode✓ at which oxidation✓ occurs.

7.3. A✓

7.4. copper (pure

7.5. Improves the conductivity✓ of the CuSO_4 electrolyte✓.

7.6. $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu(s)}$ ✓✓

7.7.1. Cu^{2+} is a stronger oxidising✓ agent than Zn^{2+} and will rather be reduced into copper✓ than zinc.

7.7.2. Gold is collected✓ in the slime and then recovered✓ and used.

7.7.3. % purity = $\frac{38,61}{39} \checkmark \times 100$
= 99%✓

7.7.4. No✓. Purity must be 99.99%✓

Question 8

8.1. Series of similar compounds that have the same functional group✓ and have the same general formula✓, in which each member differs from the previous one by a single CH_2 unit.

8.2. haloalkanes✓

8.3. 2-bromo-3-hyl-5,5-dimethylhexane✓✓ (all or nothing)

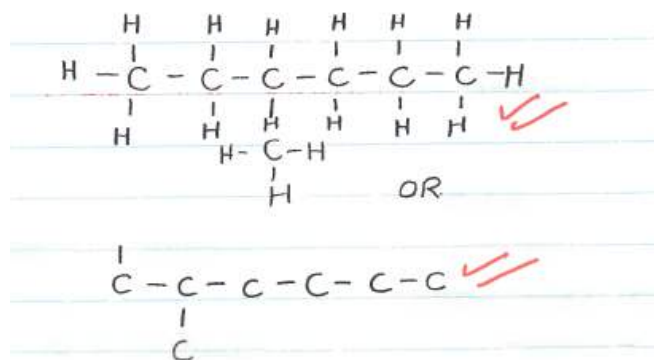
8.4. HBr ✓✓ and $\text{C}_{10}\text{H}_{20}$ ✓✓

8.5. $\text{C}_7\text{H}_{16} + 11\text{O}_2 \rightarrow 7\text{CO}_2 + * \checkmark \text{H}_2\text{O}$

8.6. Compounds having the same molecular formula✓ but different structural formulae✓

8.7. Chain isomerism✓

8.8.



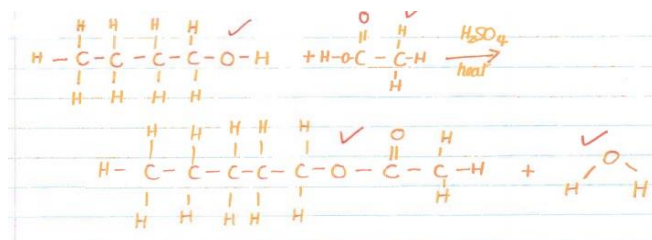
Question 9

9.1.1. esters✓

9.1.2. esterification✓

9.1.3. H_2SO_4 ✓ and heat✓

9.1.4.



9.1.5. Heptanoic acid✓

9.2.1. $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$ ✓✓

or

$\text{CH}_3(\text{CH}_2)_7\text{OH}$ ✓✓

9.2.2. Hydrolysis ✓

9.3.1. 2-methylbut-1-ene

9.3.2. Unsaturated✓ has a double bond✓

9.4. D C A B

9.5. D – London forces

C – London forces✓

A – dipole dipole✓

B – Hydrogen Bonds✓

H bonds strongest.

London Forces weakest✓,

More energy needed to overcome stronger

IMF✓