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CURRO

Heritage House

GRADE 12 - TRIAL EXAMINATION 2019

PHYSICAL SCIENCES: PAPER 2 MEMO

Question 1

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

Question 2

2.1 He ✓✓

2.2.1 polar covalent ✓

2.2.2 polar covalent ✓

2.3.1 London Forces/ Dispersion Forces ✓

2.3.2 Hydrogen Bonds ✓

2.4 The unequal ✓ sharing of electrons leading to a dipole forming. ✓

2.5 CCl₄ ✓✓

2.6 HBr has dipole dipole forces between the molecules. ✓

H₂O has hydrogen bonds between the molecules. ✓

Hydrogen bonds are stronger than dipole dipole forces. ✓

More energy is required to overcome the hydrogen bonds ✓ between the water molecules. ✓

Therefore water has a higher boiling point than HBr. ✓

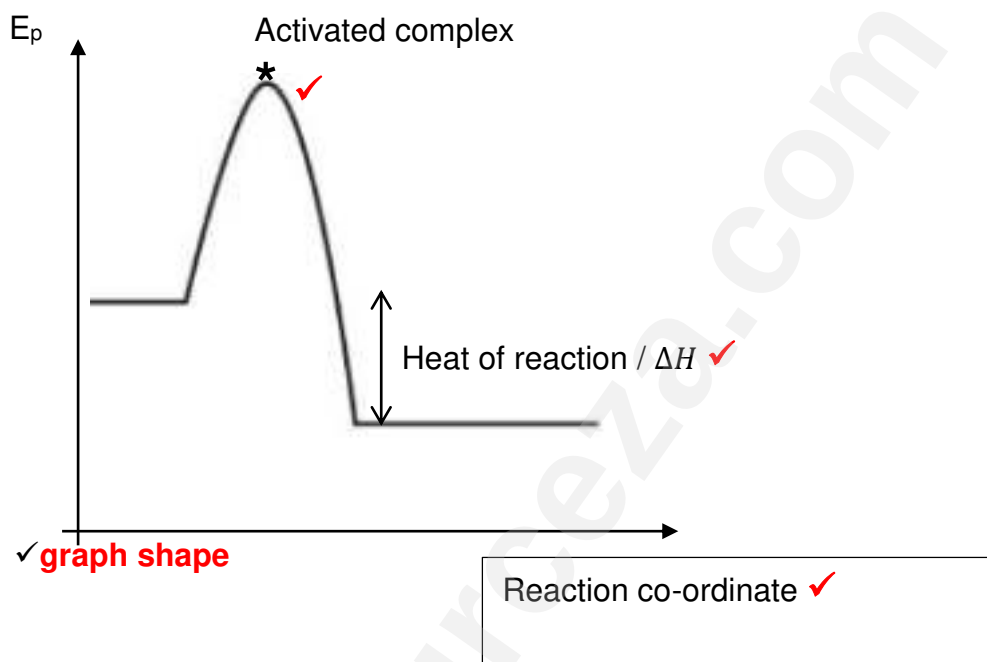
2.7 The CO₂ molecules absorb energy from their surroundings which is sufficient to overcome the weak London forces ✓ and a phase change occurs from the solid to the vapour(gas) phase. ✓

Question 3

3.1.1 Heat of reaction is the net change ✓ of chemical potential energy of the system. ✓

3.1.2 The activated complex is a high energy, unstable, ✓ temporary transition state between the reactants and the products. ✓

3.2



3.3 The CO_2 produced in the reaction is a gas ✓ and will bubble from the solution and leave the system through the cotton wool plug . ✓

3.4 In order to obtain accurate results, ✓ spillage due to splashing must be prevented. ✓

3.5 Use larger pieces of solid; use lower conc HCl ; lower temp. any two ✓✓

3.6 Collect the CO_2 gas liberated into a gas syringe/inverted measuring cylinder and measure the rate at which the volume CO_2 changes ✓

Use a pH meter to monitor the rate at which the $[\text{HCl}]$ decreases ✓

Or other suitable (e.g. quench with excess base and back titrate)

Question 4

- 4.1 in range 30 - 40% ✓✓
- 4.2.1 Increase ✓
- 4.2.2 More ✓
- 4.2.3 Stress: Increase in pressure ✓
 Response: Forward reaction is favoured ✓
 Reason: The reaction that produces the least number of moles of gas is favoured to counteract/relieve the stress and thus lowering the pressure. ✓
- 4.2.4 Endothermic ✓✓
- 4.2.5 Stress: Increase in temperature ✓
 Response: Forward reaction is favoured ✓ as more A is converted ✓
 Reason: The reaction is endothermic and would absorb the heat added to counteract/relieve the stress by lowering temperature. ✓
- 4.3.1 A substance that increases the rate of the reaction ✓ but remains unchanged at the end of the reaction. ✓
- 4.3.2 2 minutes ✓
- 4.3.3 Decreased ✓
- 4.3.4 Solid line – forward reaction ✓
- 4.3.5 Stress: Decrease in temperature ✓
 Response: Both reaction rates slows down but the favoured reaction slows down the least. ✓ From the table the increase in temperature favours the forward reaction, so a decrease in temp will favour the reverse reaction. ✓
 Reason: The reverse reaction is exothermic that will release heat to counteract/relieve the stress by increasing the temperature. ✓
- 4.3.6 Stress: Remove reactant [A] or [B] ✓
 Response: (Both reaction rates slows down but the favoured reaction slows down the least) ✓ the reverse reaction is favoured. ✓
 Reason: The reverse reaction will replace the reactants that has been removed to counteract/relieve the stress by increasing the reactants. ✓
- 4.4.1 The stage in a chemical reaction when the rate of forward reaction equals the rate of reverse reaction. ✓✓
- 4.4.2 $c = \frac{n}{v} = \frac{2}{5} = 0,4 \text{ mol. dm}^{-3}$ ✓

4.4.3

	C	2D	2E
Ratio	1	2	2
Initial	3	x	
Change	2	4	4
Equilibrium	1	$x-4$ ✓	4✓
Conc	0,2✓	$\frac{x-4}{5}$	0,8✓

$$K_c = \frac{[E]^2}{[C][D]^2} \checkmark$$

$$0.625 \checkmark = \frac{(0.8)^2 \checkmark}{(0.2) \left(\frac{x-4}{5} \right)^2}$$

$$x = 15,3 \text{ mols} \checkmark$$

$$\text{mols added} = 15.3 - 6 = 9.3 \text{ mols} \checkmark$$

Question 5

5.1 A substance that can conduct electricity✓ by forming free ions when molten or dissolved in solution. ✓

5.2 Nail✓

5.3 $\text{Cu}^{2+} + 2 \text{e}^- \rightarrow \text{Cu}$ ✓✓

5.4 $\text{Cu} \rightarrow \text{Cu}^{2+} + 2 \text{e}^-$ ✓✓

5.5 the flow of electrons will be from 2 to 1✓

5.6.1 $n = \frac{m}{M} = \frac{0.7}{63.5} \checkmark = 0.011 \text{ mols} \checkmark$

5.6.2 $N = nN_A \checkmark = (2 \times 0.011 \checkmark)(6.02 \times 10^{23} \checkmark) = 1.32 \times 10^{22} \checkmark$

5.7 Allow the current to flow for a longer time. ✓

5.8 Extraction of aluminium from ore; ✓
Electro-refining of impure copper.
Chlor-alkali industry
Any suitable example

Question 6

- 6.1 Chemical to electrical ✓✓
- 6.2 $\text{Cd}_{(s)}|\text{Cd}^{2+}_{(aq)} (1 \text{ mol.dm}^{-3}) \parallel \text{Ag}^{+}_{(aq)} (1 \text{ mol.dm}^{-3}) |\text{Ag}_{(s)}$ ✓✓ at 25° C ✓
- 6.3 Oxidising agent is an electron acceptor. ✓✓
- 6.4 Ag^{+} ✓
- 6.5 $E^{\ominus}_{\text{cell}} = E^{\ominus}_{\text{cathode}} - E^{\ominus}_{\text{anode}} = 0,8 - (-0,4) = 1,2\text{V}$ ✓
- 6.6 - completing the circuit ✓
- maintaining electrical neutrality in the half-cells ✓
- 6.7 Anions (NO_3^-) flow to the cadmium cell. ✓
As a result of oxidation of the cadmium anode the concentration of positive cadmium ions (cations) in the cadmium half-cell increases therefore the negative ions (anions) ✓ move into the cadmium half-cell in order to maintain electrical neutrality (maintain balance between positive and negative ions). ✓
- 6.8 emf will increase ✓
adding AgNO_3 solution the concentration of Ag^{+} increases ✓
favouring the forward reaction in the Ag cell ✓
- 6.9 emf will decrease ✓
adding NaCl to the Ag cell will cause AgCl to precipitate (common ion effect)
decreasing the concentration of the Ag^{+} ✓

Question 7

7.1.1 A substance in which the hydrogen of an acid has been replaced by a cation

7.1.2 hydrolysis

7.1.3 Acidic

7.1.4 $\text{NH}_3 \checkmark + \text{HCl} \checkmark \rightarrow \text{NH}_4\text{Cl} \checkmark$

7.2.1 $n = cv \checkmark = (0.1)(0.1) \checkmark = 0.01 \text{ mol} \checkmark$

7.2.2 The point where an acid and base have reacted $\checkmark$ so neither is in excess. $\checkmark$
Also defined as the equivalence point.

7.2.3 $n(\text{HCl}) = cv = (0.11) \left(\frac{14.55}{1000} \right) \checkmark = 1.6 \times 10^{-3} \text{ mols} \checkmark$
 $n(\text{Excess NaOH}) = 1.6 \times 10^{-3} \times 4 \checkmark = 6.4 \times 10^{-3} \text{ mols}$
 $n(\text{NaOH reacted with NH}_4\text{Cl}) = 0.01 - 6.4 \times 10^{-3} \checkmark = 3.6 \times 10^{-3}$

$m(\text{NH}_4\text{Cl}) = 3.6 \times 10^{-3} \times (14 + 4 + 35.5) \checkmark = 0.193 \text{ g}$

$\text{mass of fertilizer} = \frac{0.193}{0.92} \checkmark = 0.21 \text{ g} \checkmark$

7.3.1 A base is defined as a proton acceptor. $\checkmark \checkmark$

7.3.2 Ammonia $\checkmark$ – higher K_b value $\checkmark$ – stronger base which dissociates to a greater degree $\checkmark$ – more ions in solution to carry charge. $\checkmark$

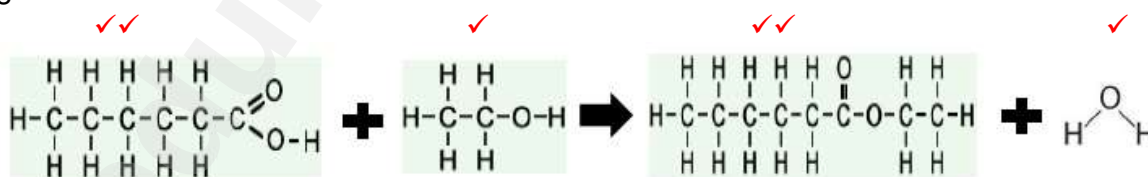
7.3.3 $\text{H}_2\text{CO}_3 + \text{H}_2\text{O} \checkmark \rightleftharpoons \text{HCO}_3^{-1} \checkmark + \text{H}_3\text{O}^+ \checkmark$ OR $\text{H}_2\text{CO}_3 + 2\text{H}_2\text{O} \rightleftharpoons \text{CO}_3^{-2} + 2\text{H}_3\text{O}^+$

Question 8

8.1 ethanol $\checkmark \checkmark$

8.2 Dehydrating agent $\checkmark$

8.3



8.4 Alcohol is flammable and catches alight easily. $\checkmark$ This is a safer method to heat it. $\checkmark$

8.5 Substances that have the same molecular formula but different structural formula $\checkmark \checkmark$

8.6 Propyl pentanoate (any) $\checkmark \checkmark$

Question 9

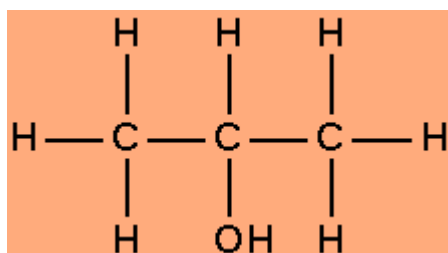
9.1.1 Addition ✓

9.1.2 Substitution ✓

9.1.3 elimination ✓

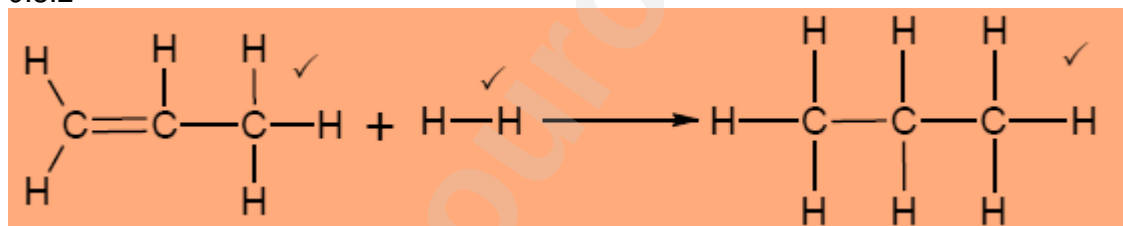
9.2.1 $\text{H}_2\text{SO}_4 / \text{H}_3\text{PO}_4$ ✓

9.2.2 ✓✓



9.3.1 Hydrogenation ✓

9.3.2



9.4.1 2-chloropropane ✓✓

9.4.2 Sodium hydroxide / Potassium hydroxide ✓

9.4.3 Dilute base ✓ and mild heat ✓

9.5.1 (i) $\text{C}_2\text{H}_6 + \text{Br}_2 \rightarrow \text{C}_2\text{H}_5\text{Br} + \text{HBr}$ ✓

(ii) $\text{C}_2\text{H}_5\text{Br} + \text{NaOH} \rightarrow \text{C}_2\text{H}_5\text{OH} + \text{NaBr}$ ✓

9.5.2 Substitution ✓

9.5.3 Substitution ✓