External assessment 2025

Multiple choice question book

Chemistry

Paper 1

General instruction

- Work in this book will not be marked.

Queensland Government | QCAA Queensland Curriculum & Assessment Authority

Section 1

Instruction

- Respond to these questions in the question and response book.

QUESTION 1

Which species is produced at the cathode during the electrolysis of an aqueous copper sulfate $(CuSO_4)$ solution using platinum electrodes?

(A) $Cu(s)$

(B) $H_2(g)$

(C) $O_2(g)$

(D) $SO_2(aq)$

QUESTION 2

Determine the tertiary haloalkane.

(A) 2,2-dibromobutane

(B) 2,3,3-tribromobutane

(C) 2-bromo-2-methylbutane

(D) 2-bromo-3-methylbutane

QUESTION 3

Identify the amphiprotic species.

(A) $NH_4^+(aq)$

(B) $H_3O^+(aq)$

(C) $CO_3^{2-}(aq)$

(D) $HCO_3^-(aq)$

QUESTION 4

Which type of reaction occurs when an alcohol reacts with a carboxylic acid to form an ester?

(A) addition

(B) hydrolysis

(C) condensation

(D) polymerisation

QUESTION 5

A 25.00 mL aliquot of aqueous potassium hydroxide (KOH) solution was titrated against an aqueous solution of 0.100 M hydrochloric acid (HCl). It took 17.45 mL of HCl to reach the equivalence point.

Determine the concentration of the $\mathrm{KOH(aq)}$ solution.

(A) 2.29×10^{-1} M

(B) 1.43×10^{-1} M

(C) 6.98×10^{-2} M

(D) 4.36×10^{-5} M

QUESTION 6

Determine which statement is true for an electrolytic cell used for electroplating.

(A) The redox reaction is spontaneous.

(B) The anode is the object to be plated.

(C) The cathode is reduced to replenish the metal ions.

(D) The electrolyte contains the metal ions that plate the object.

QUESTION 7

Which of the following is exchanged with the surroundings when a chemical reaction reaches dynamic equilibrium?

(A) gases

(B) matter

(C) energy

(D) products

QUESTION 8

Which is the most concentrated weak base?

(A) 2.0 M $KOH(aq)$

(B) 0.2 M $NaOH(aq)$

(C) 2.0 M $NH_4OH(aq)$

(D) 0.2 M $Al(OH)_3(aq)$

QUESTION 9

Which protein structure contains two or more protein chains bonded together to form subunits?

(A) primary

(B) secondary

(C) tertiary

(D) quaternary

QUESTION 10

Methane (CH_4) reacts with water to produce carbon monoxide (CO) and hydrogen (H_2).

$$CH_4(g) + H_2O(g) \rightarrow CO(g) + 3H_2(g)$$

Determine the reducing agent.

(A) H in H_2

(B) C in CH_4

(C) H in CH_4

(D) O in H_2O

QUESTION 11

Yeasts are used in the production of ethanol by fermentation to

(A) increase the rate of the reaction.

(B) act as a reactant in the overall reaction.

(C) increase the yield of ethanol and ensure its purity.

(D) produce green ethanol by preventing the production of carbon dioxide.

QUESTION 12

Predict the colour change that occurs when 1-propanol is oxidised to propanoic acid using acidified potassium dichromate (VI).

(A) red to yellow

(B) orange to green

(C) purple to brown

(D) pink to colourless

QUESTION 13

Which monosaccharide undergoes a condensation reaction with glucose to form sucrose?

(A) galactose

(B) fructose

(C) glucose

(D) maltose

QUESTION 14

Increasing the pH of an aqueous solution of hydrochloric acid (HCl) from 2 to 4

(A) reduces the strength of the acid.

(B) increases the acidity of the solution.

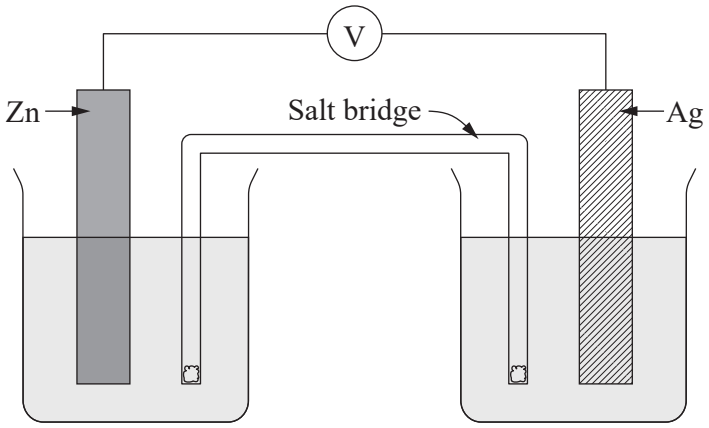
(C) increases the concentration of H^+ ions by a factor of 2.

(D) reduces the concentration of H^+ ions by a factor of 100.

QUESTIONS 15–16

Questions 15–16 refer to the galvanic cell shown.

$$Zn(s) \mid Zn^{2+}(aq) \parallel Ag^{+}(aq) \mid Ag(s)$$



QUESTION 15

Calculate the cell potential for the galvanic cell under standard conditions.

(A) +0.04 V

(B) +0.84 V

(C) +1.56 V

(D) +2.36 V

QUESTION 16

Deduce the reaction occurring at the anode for the galvanic cell.

(A) $Zn^{2+}(aq) + 2e^{-} \rightleftharpoons Zn(s)$

(B) $Zn(s) \rightleftharpoons Zn^{2+}(aq) + 2e^{-}$

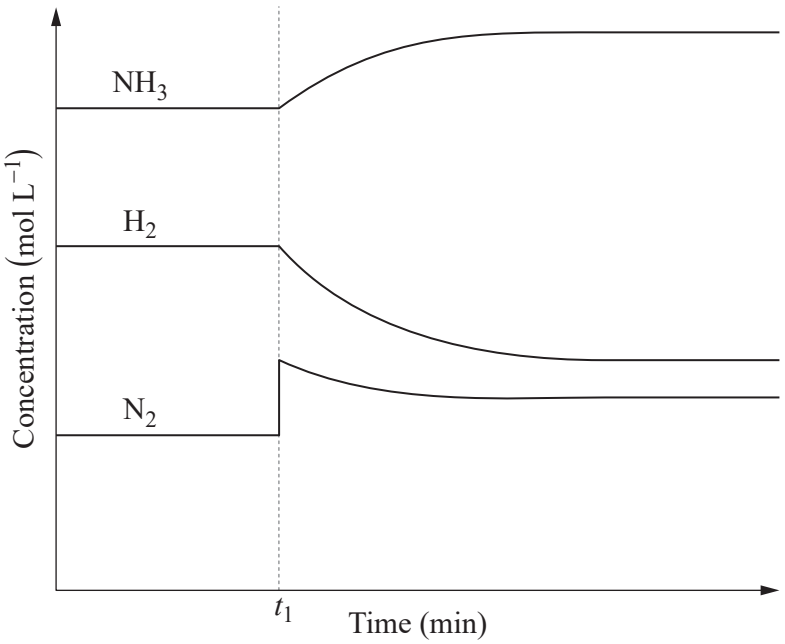
(C) $Ag(s) \rightleftharpoons Ag^{+}(aq) + e^{-}$

(D) $Ag^{+}(aq) + e^{-} \rightleftharpoons Ag(s)$

QUESTIONS 17–18

Questions 17–18 refer to the relationship between the concentration of nitrogen (N_2), hydrogen (H_2) and ammonia (NH_3) in a closed system, as shown.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) + \text{heat}$$



QUESTION 17

Determine the equilibrium law expression (K_c) for the reaction.

(A) $K_c = \dfrac{2[NH_3]}{[N_2]3[H_2]}$

(B) $K_c = \dfrac{[NH_3]^2}{[N_2][H_2]^3}$

(C) $K_c = \dfrac{6[NH_3]}{2[N_2]6[H_2]}$

(D) $K_c = \dfrac{[NH_3]^6}{[N_2]^2[H_2]^6}$

QUESTION 18

Determine the change applied to the system at t_1.

(A) $N_2(g)$ was added.

(B) Pressure was increased.

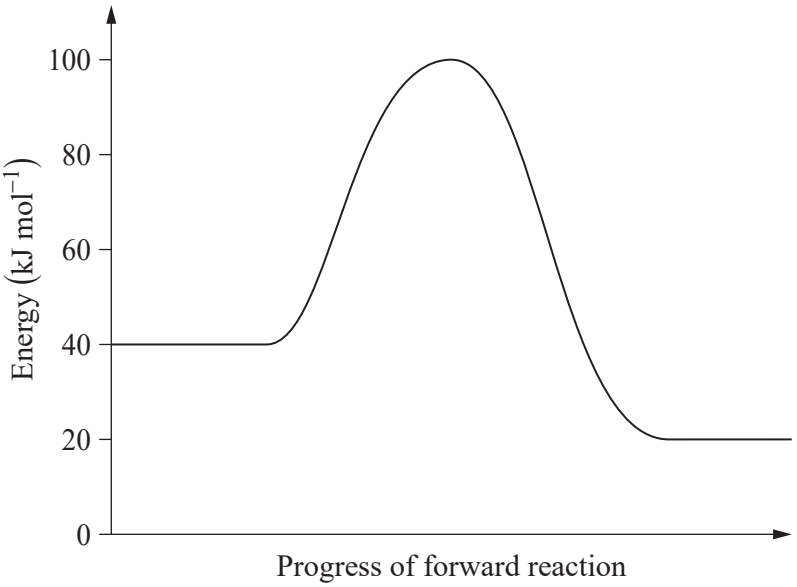
(C) Temperature was increased.

(D) $N_2(g)$ and $NH_3(g)$ were added.

QUESTIONS 19–20

Questions 19–20 refer to the reversible chemical reaction and enthalpy level diagram shown.

$$2AB_2(g) + B_2(g) \rightleftharpoons 2AB_3(g)$$



QUESTION 19

Which statement is true for the forward reaction?

(A) Energy is a product.

(B) The reaction is endothermic.

(C) Enthalpy change (ΔH) is positive.

(D) Activation energy (E_a) is less than enthalpy change (ΔH).

QUESTION 20

Determine the activation energy (E_a) of the reverse reaction.

(A) 20 kJ mol^{-1}

(B) 40 kJ mol^{-1}

(C) 60 kJ mol^{-1}

(D) 80 kJ mol^{-1}

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