External assessment 2022

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

QUESTION 1

Identify the type of reaction that occurs when ethene undergoes polymerisation to form polyethene.

(A) addition

(B) elimination

(C) substitution

(D) condensation

QUESTION 2

Structural isomers are compounds with the same molecular formula but a different

(A) molar mass.

(B) molecular mass.

(C) empirical formula.

(D) arrangement of atoms.

QUESTION 3

Which option is true for the redox equation?

$$Fe(s) + CuCl_2(aq) \rightarrow FeCl_2(aq) + Cu(s)$$

(A) Fe is oxidised and Cu is the oxidising agent

(B) Fe is oxidised and Cu^{2+} is the oxidising agent

(C) Fe^{2+} is oxidised and Cu is the oxidising agent

(D) Fe^{2+} is oxidised and Cu^{2+} is the oxidising agent

QUESTION 4

Which pair of reagents would react to form a glycosidic bond?

(A) lysine and aniline

(B) glucose and galactose

(C) methanol and butanoic acid

(D) glycerol and sodium hydroxide

QUESTION 5

Phosphorus pentoxide is prepared by burning phosphorus in oxygen.

$$P_4(s) + 5O_2(g) \rightarrow P_4O_{10}(s)$$

Calculate the percentage yield if 10.0 g of P_4O_{10} is produced when 0.200 mol of P_4 and 0.200 mol of O_2 are reacted.

(A) 2.0%

(B) 3.5%

(C) 17.6%

(D) 88.0%

QUESTION 6

The equilibrium concentration of A is 2.8×10^{-4} M and B is 1.2×10^{-4} M.

$$\mathrm{A(g)} \rightleftharpoons \mathrm{B(g)} \quad \Delta H > 0$$

Which option represents the ratio of molecules present in a sample of the gaseous mixture when the temperature is decreased and a new equilibrium established?

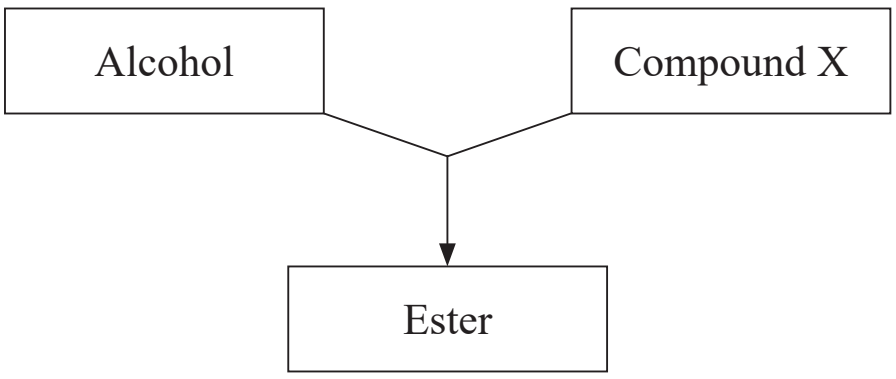
(A) 8 molecules of A and 2 molecules of B

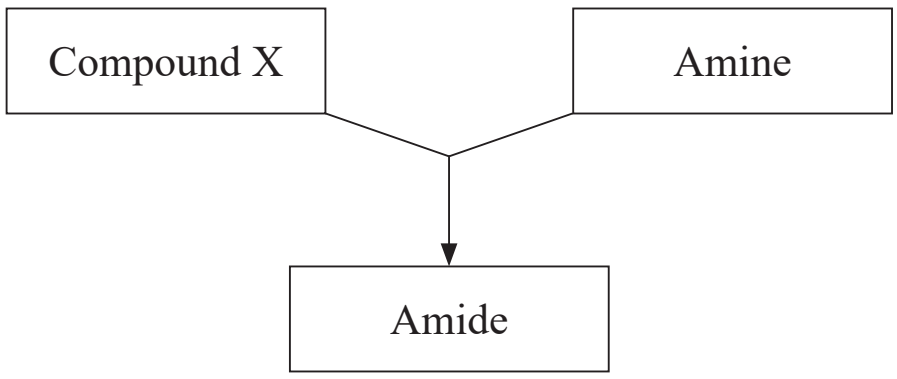
(B) 5 molecules of A and 5 molecules of B

(C) 3 molecules of A and 7 molecules of B

(D) 2 molecules of A and 8 molecules of B

QUESTION 7





Compound X in these reaction pathways is

(A) a ketone.

(B) an alkene.

(C) an aldehyde.

(D) a carboxylic acid.

QUESTION 8

Predict how the system shown will respond when a small amount of aqueous sodium hydroxide is added.

$$CH_3COOH(aq) + H_2O(l) \rightleftharpoons CH_3COO^-(aq) + H_3O^+(aq)$$

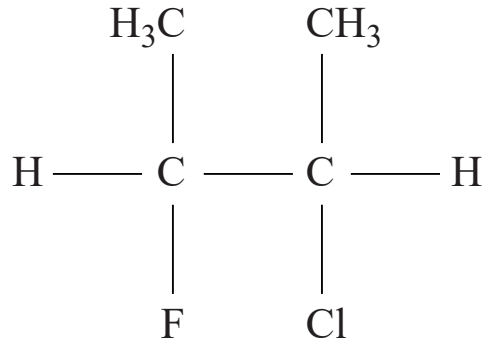
(A) Equilibrium shifts to the left and the pH decreases.

(B) Equilibrium shifts to the right and the pH increases.

(C) Equilibrium shifts to the left and the pH remains the same.

(D) Equilibrium shifts to the right and the pH remains the same.

QUESTION 9



The IUPAC name for this molecule is

(A) 2-chloro-3-fluorobutane.

(B) 2-fluoro-3-chlorobutane.

(C) 2-dimethyl-1-chloro-2-fluoroethane.

(D) 1,2-dimethyl-1-fluoro-2-chloroethane.

QUESTION 10

The midpoint of the colour change of a weak acid indicator occurs when

(A) $[In^-] = [H^+]$

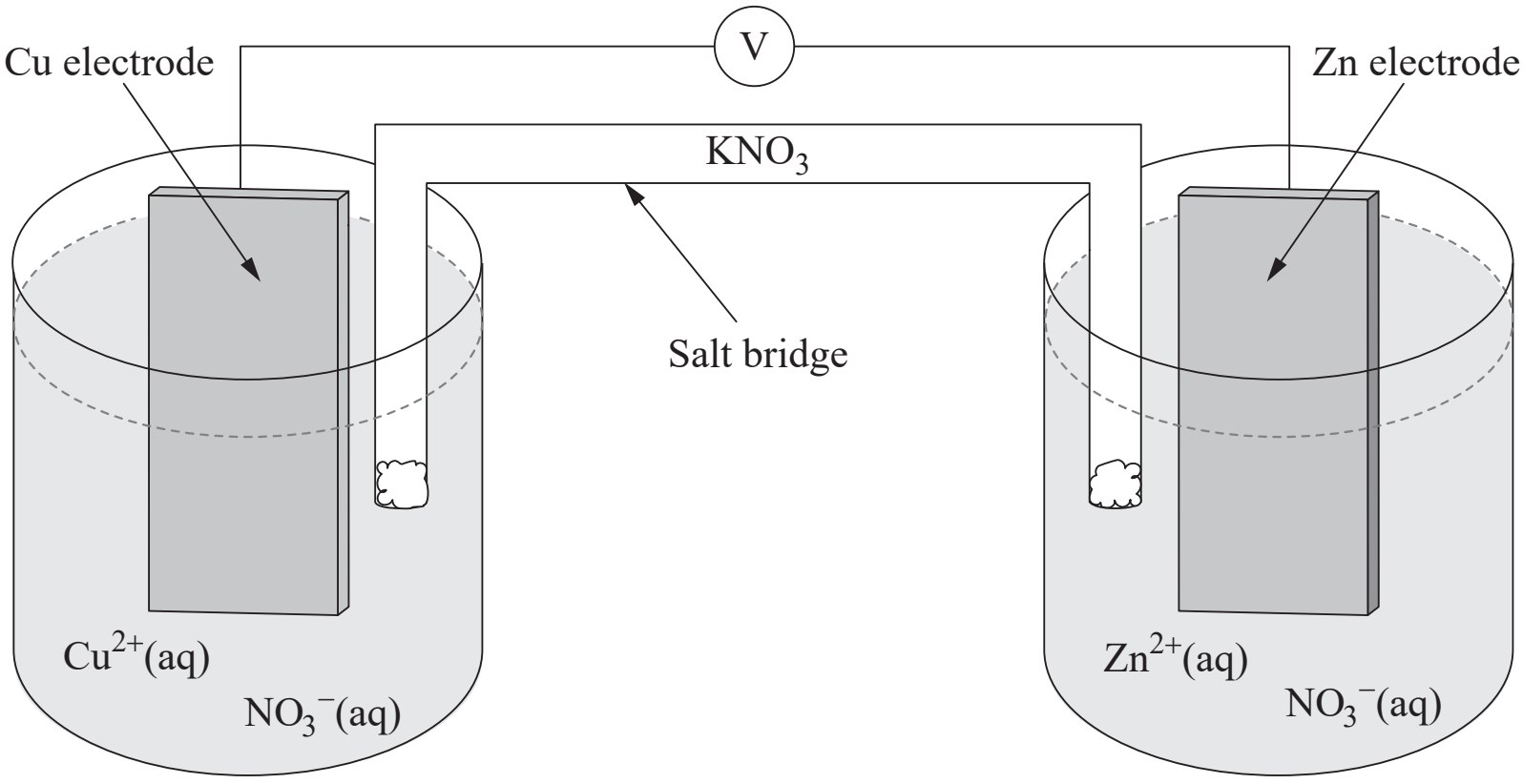
(B) $[In^-] = [HIn]$

(C) $[H^+] = [OH^-]$

(D) $[HIn] = [OH^-]$

QUESTIONS 11–12

These questions refer to the diagram shown.



QUESTION 11

Determine the species that travels through the salt bridge towards the reduction half-cell in the electrochemical cell at standard conditions.

(A) zinc ions

(B) nitrate ions

(C) copper ions

(D) potassium ions

QUESTION 12

The zinc electrode

(A) gains electrons and acts as the anode.

(B) acts as the cathode and has a positive charge.

(C) undergoes reduction and has a negative charge.

(D) is oxidised and donates electrons to the copper ions.

QUESTION 13

Determine the K_a of an unknown weak acid (HA) with an aqueous concentration of 0.12 M and a pH of 3.2.

(A) 5.2×10^{-3}

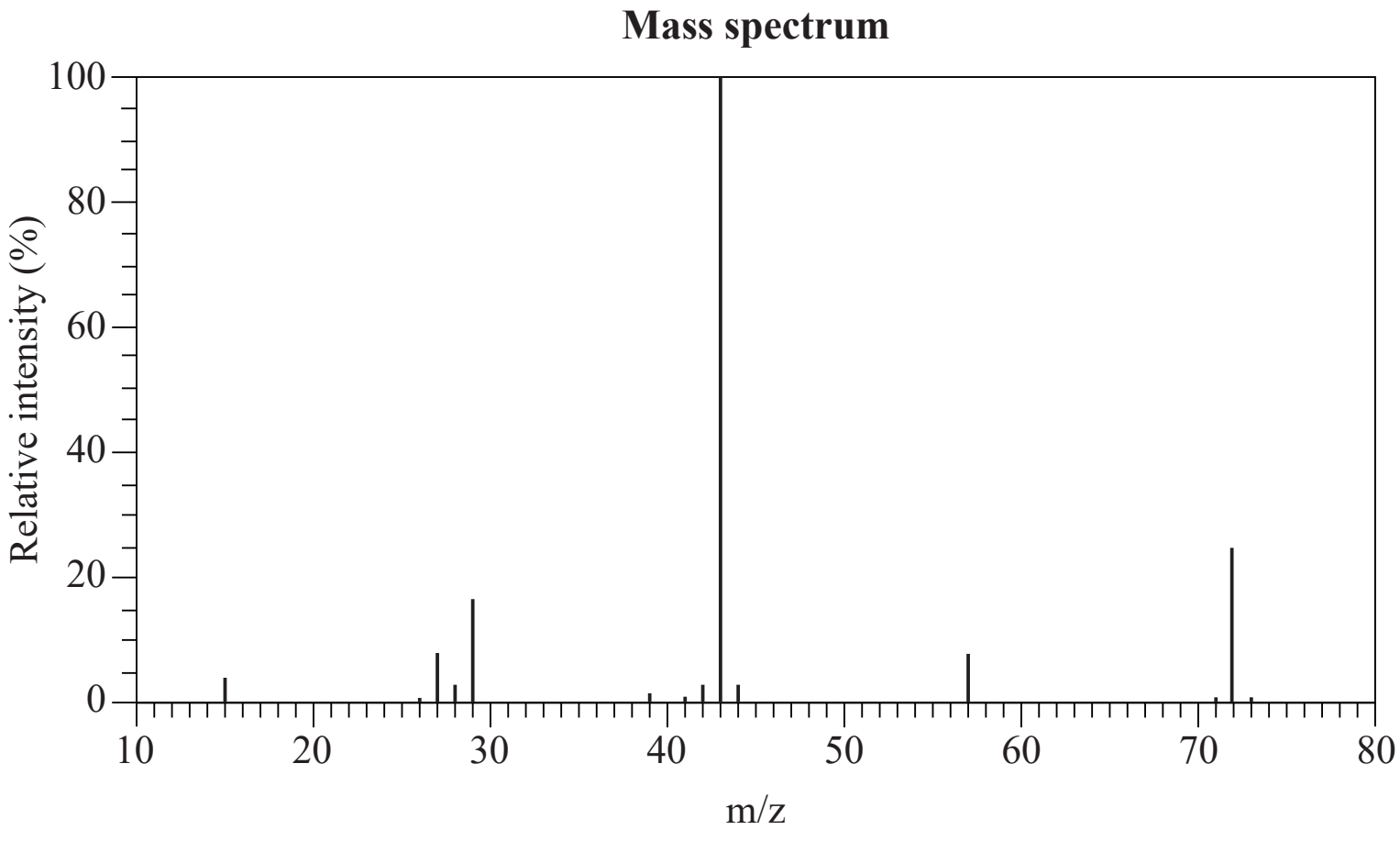
(B) 6.3×10^{-4}

(C) 3.3×10^{-6}

(D) 4.0×10^{-7}

QUESTION 14

The mass spectrum for Compound X is found to have signals at the following m/z values.



Compound X is

(A) butanal.

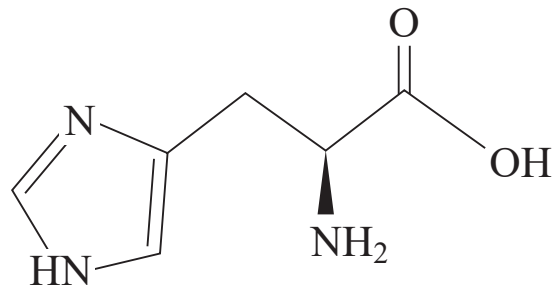
(B) butanol.

(C) butanone.

(D) butanoic acid.

QUESTION 15

The structure of an amino acid is shown.



This molecule contains an amine group and a

(A) carboxyl group.

(B) hydroxy group.

(C) methyl group.

(D) ketone group.

QUESTION 16

Determine the oxidation state of manganese in MnO_4^-.

(A) +1

(B) +2

(C) +7

(D) +8

QUESTION 17

Identify the redox reaction.

(A) $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$

(B) $CaO(s) + H_2O(l) \rightarrow Ca(OH)_2(s)$

(C) $Cl_2(g) + H_2O(l) \rightarrow HCl(aq) + HClO(aq)$

(D) $NaOH(aq) + HCl(aq) \rightarrow NaCl(aq) + H_2O(l)$

QUESTION 18

Determine the K_b expression for the weak base shown in the equilibrium equation.

$$NH_3(aq) + H_2O(l) \rightleftharpoons NH_4^+(aq) + OH^-(aq)$$

(A) $K_b = \dfrac{[NH_3][H_2O]}{[NH_4^+]}$

(B) $K_b = \dfrac{[NH_3][H_2O]}{[OH^-]}$

(C) $K_b = \dfrac{[NH_4^+][OH^-]}{[NH_3]}$

(D) $K_b = \dfrac{[NH_4^+][OH^-]}{[H_2O]}$

QUESTION 19

Three voltaic cells are constructed with metal Q as one electrode and metals R, S or T as the other electrode. The potential differences for the cells are shown in the table.

Voltaic cell	Half-cell	Half-cell	Potential difference (V)
1	$Q(s) / Q^{2+}(aq)$	$R^+(aq) / R(s)$	1.18
2	$Q(s) / Q^{2+}(aq)$	$S^{2+}(aq) / S(s)$	0.72
3	$T(s) / T^{3+}(aq)$	$Q^{2+}(aq) / Q(s)$	0.95

The relative strength of the reducing agents from strongest to weakest is

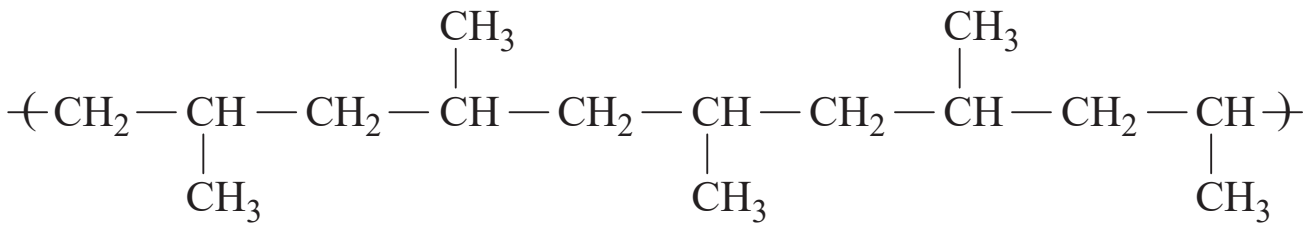
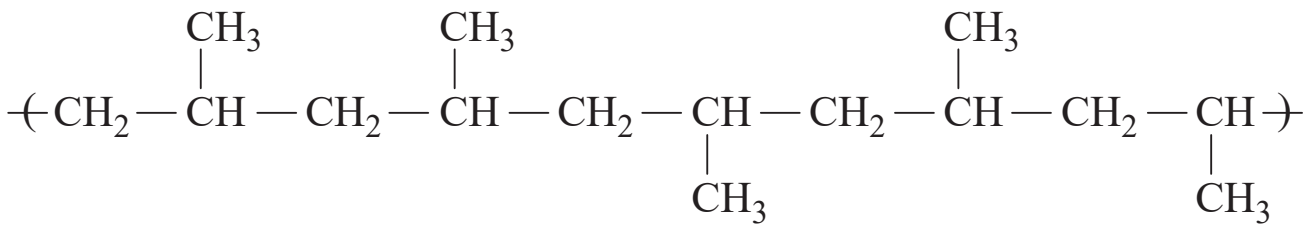
(A) T > Q > S > R

(B) S > Q > T > R

(C) R > Q > S > T

(D) Q > R > T > S

QUESTION 20

1	
2	

The two forms of polypropene shown are

	1	**2**
(A)	syntactic	atactic
(B)	isotactic	atactic
(C)	isotactic	syntactic
(D)	atactic	syntactic

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References

Question 14

Mass spectrum (electron ionization), https://webbook.nist.gov/cgi/cbook.cgi?ID=C78933&Mask=200#Mass-Spec, © 2021 by the U.S. Secretary of Commerce on behalf of the United States of America. All rights reserved.