

External assessment

Multiple choice question book

Chemistry

Paper 1

General instruction

- Work in this book will not be marked.



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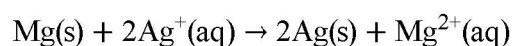
Section 1

QUESTION 1

A partly filled water bottle is sealed and left on a bench in a room with a constant temperature. After several minutes, it is noted that the water level in the bottle remains constant. In the water bottle, the rate of evaporation is

- (A) less than the rate of condensation.
- (B) greater than the rate of condensation.
- (C) equal to the rate of condensation and equal to zero.
- (D) equal to the rate of condensation but not equal to zero.

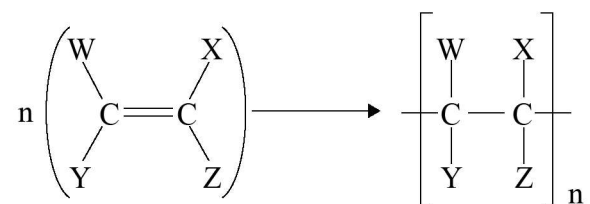
QUESTION 2



Determine which of the following statements is true for the chemical reaction.

- (A) Silver ions are reduced and act as a reducing agent.
- (B) Silver ions are oxidised and act as a reducing agent.
- (C) Magnesium atoms are reduced and act as a reducing agent.
- (D) Magnesium atoms are oxidised and act as a reducing agent.

QUESTION 3

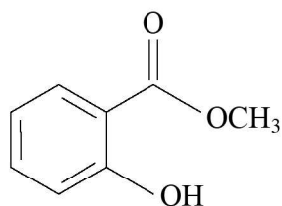


This general chemical equation represents the following type of reaction.

- (A) addition
- (B) hydrolysis
- (C) esterification
- (D) condensation

QUESTION 4

Oil of wintergreen is a chemical compound with the following chemical structure.



Identify the functional groups present in oil of wintergreen.

- (A) alcohol and ester
- (B) alcohol and ketone
- (C) alcohol and aldehyde
- (D) alcohol and carboxylic acid

QUESTION 5

The equilibrium constants of four different reactions are given.

In which reaction does the equilibrium lie furthest to the left?

	Reaction	K_c
(A)	$\text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g}) \rightleftharpoons \text{PCl}_5(\text{g})$	2.4×10^1
(B)	$\text{AgIO}_3(\text{s}) \rightleftharpoons \text{Ag}^+(\text{aq}) + \text{IO}_3^-(\text{aq})$	3.0×10^{-8}
(C)	$\text{Cl}_2(\text{g}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{HOCl}(\text{aq}) + \text{Cl}^-(\text{aq}) + \text{H}^+(\text{aq})$	4.0×10^{-4}
(D)	$\text{HSO}_3^-(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{H}_3\text{O}^+(\text{aq}) + \text{SO}_3^{2-}(\text{aq})$	6.3×10^{-8}

QUESTION 6

Calculate the cell potential produced by a $\text{Zn}(\text{s}) \mid \text{Zn}^{2+}(\text{aq}) \parallel \text{Cu}^{2+}(\text{aq}) \mid \text{Cu}(\text{s})$ galvanic cell under standard conditions.

- (A) -1.10 V
- (B) -0.42 V
- (C) $+0.34 \text{ V}$
- (D) $+1.10 \text{ V}$

QUESTION 7

Acid	Concentration (M)	pH
H_3PO_4	2.0×10^{-2}	1.9
HCN	1.5×10^{-1}	5.0
H_2SO_4	9.0×10^{-2}	1.0
CH_3COOH	1.0×10^{-1}	2.8

Analyse the experimental data to determine the relative strength of the acids from strongest to weakest.

- (A) $\text{H}_2\text{SO}_4 > \text{H}_3\text{PO}_4 > \text{HCN} > \text{CH}_3\text{COOH}$
- (B) $\text{H}_2\text{SO}_4 > \text{H}_3\text{PO}_4 > \text{CH}_3\text{COOH} > \text{HCN}$
- (C) $\text{HCN} > \text{CH}_3\text{COOH} > \text{H}_2\text{SO}_4 > \text{H}_3\text{PO}_4$
- (D) $\text{HCN} > \text{CH}_3\text{COOH} > \text{H}_3\text{PO}_4 > \text{H}_2\text{SO}_4$

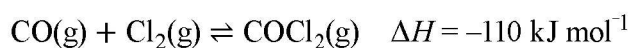
QUESTION 8

An organic compound, X, reacts with sodium hydrogen carbonate to form carbon dioxide gas. Compound X is

- (A) an amine.
- (B) a haloalkane.
- (C) a carboxylic acid.
- (D) a primary alcohol.

QUESTION 9

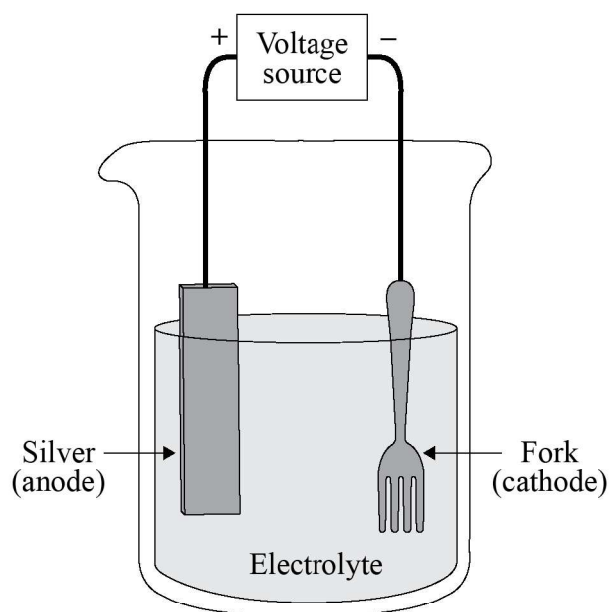
Phosgene gas (COCl_2) is formed by the following reaction.



Which of the following statements is true for the system at equilibrium?

- (A) Removing $\text{Cl}_2\text{(g)}$ will increase the yield of phosgene and keep the K_c value constant.
- (B) Adding a catalyst will increase the yield of phosgene and keep the K_c value constant.
- (C) Increasing the pressure will increase the yield of phosgene and keep the K_c value constant.
- (D) Decreasing the temperature will decrease the yield of phosgene and keep the K_c value constant.

QUESTION 10



Which of the following is true for the electrochemical cell?

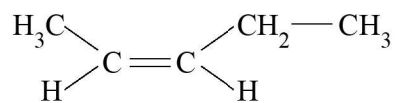
	Reaction	Anode	Flow of electrons
(A)	spontaneous	oxidation	From the negative terminal of the power pack, through the wire to the negative electrode.
(B)	spontaneous	positive electrode	From the positive terminal of the power pack, through the wire and the electrolyte to the negative electrode.
(C)	non-spontaneous	negative electrode	From the negative terminal of the power pack, through the wire and the electrolyte to the positive terminal.
(D)	non-spontaneous	oxidation	From the negative terminal of the power pack, through the wire to the negative electrode.

QUESTION 11

Determine the colour of a solution with a pH of 9.6 containing bromocresol green indicator.

- (A) pink
- (B) blue
- (C) green
- (D) yellow

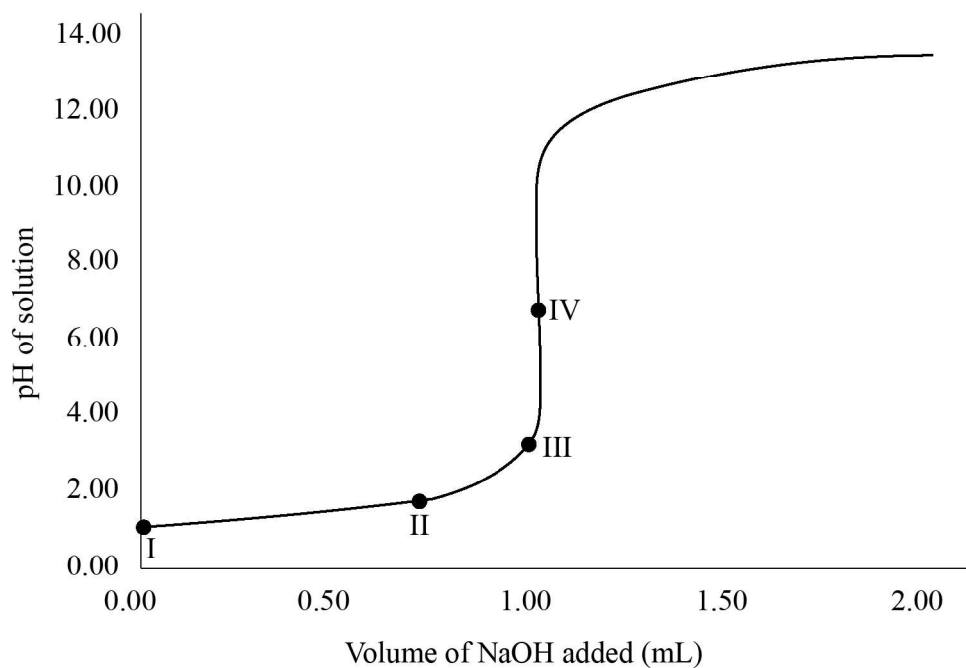
QUESTION 12



Apply IUPAC rules to name the molecule.

- (A) *cis*-2-pentene
- (B) *trans*-2-pentene
- (C) *cis*-1-ethyl-2-methylethene
- (D) *trans*-1-ethyl-2-methylethene

QUESTION 13

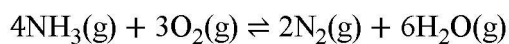


Identify the equivalence point on the titration curve.

- (A) I
- (B) II
- (C) III
- (D) IV

QUESTION 14

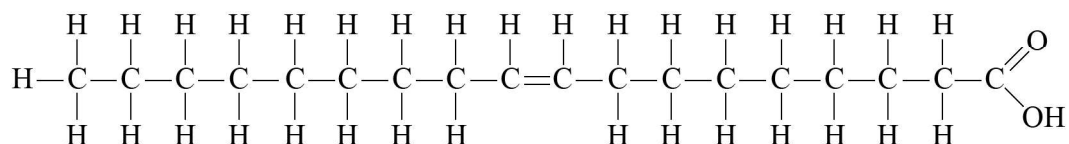
Ammonia gas reacts with oxygen gas in the following equilibrium reaction.



The equilibrium expression for the reaction is

- (A) $\frac{[\text{NH}_3][\text{O}_2]}{[\text{N}_2][\text{H}_2\text{O}]}$
- (B) $\frac{[\text{N}_2][\text{H}_2\text{O}]}{[\text{NH}_3][\text{O}_2]}$
- (C) $\frac{[\text{NH}_3]^4[\text{O}_2]^3}{[\text{N}_2]^2[\text{H}_2\text{O}]^6}$
- (D) $\frac{[\text{N}_2]^2[\text{H}_2\text{O}]^6}{[\text{NH}_3]^4[\text{O}_2]^3}$

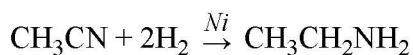
QUESTION 15



This compound is an unsaturated fatty acid because it contains a

- (A) double bond and a carboxylic acid group.
- (B) long carbon chain and a carboxylic acid group.
- (C) double bond, an aldehyde group and a hydroxyl group.
- (D) long carbon chain, an aldehyde group and a hydroxyl group.

QUESTION 16



The reaction shows

- (A) an addition reaction that converts an amine to a nitrile.
- (B) a reduction reaction that converts a nitrile to an amine.
- (C) an oxidation reaction that converts an amine to a nitrile.
- (D) a substitution reaction that converts a nitrile to an amine.

QUESTION 17

Which of the following represents a spontaneous redox reaction with the correct standard electrode potential?

	Reaction	E° (V)
(A)	$2\text{Na}^+(\text{aq}) + 2\text{Br}^-(\text{aq}) \rightarrow 2\text{Na}(\text{s}) + \text{Br}_2(\text{aq})$	3.79
(B)	$\text{Sn}^{2+}(\text{aq}) + 2\text{Ag}(\text{s}) \rightarrow \text{Sn}(\text{s}) + 2\text{Ag}^+(\text{aq})$	-0.94
(C)	$\text{Zn}(\text{s}) + \text{Cl}_2(\text{g}) \rightarrow \text{Zn}^{2+}(\text{aq}) + 2\text{Cl}^-(\text{aq})$	2.12
(D)	$2\text{Al}(\text{s}) + 3\text{Sn}^{2+}(\text{aq}) \rightarrow 2\text{Al}^{3+}(\text{aq}) + 3\text{Sn}(\text{s})$	1.82

QUESTION 18

Solution A has a pH of 3 and solution B has a pH of 6. This indicates that solution A is

- (A) less acidic and has 0.5 times the concentration of hydrogen ions in solution B.
- (B) more acidic and has 2 times the concentration of hydrogen ions in solution B.
- (C) less acidic and has 0.001 times the concentration of hydrogen ions in solution B.
- (D) more acidic and has 1000 times the concentration of hydrogen ions in solution B.

QUESTION 19

Dispersion forces, hydrogen bonding, disulfide bridges and ionic bonding all contribute to the

- (A) primary structure of proteins.
- (B) secondary structure of proteins.
- (C) tertiary structure of proteins.
- (D) quaternary structure of proteins.

QUESTION 20

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View electrochemical cell Figure 17.3 in OpenStax Galvanic Cells
<https://openstax.org/books/chemistry-2e/pages/17-2-galvanic-cells>.

Determine which of the following statements is true for the electrochemical cell.

- (A) Copper ions are reduced.
- (B) Copper is the positive electrode.
- (C) Electrons flow through the salt bridge.
- (D) Oxidation occurs on the surface of the copper.

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References

Question 10

Adapted from OpenStax 2016, Chemistry: 17.7 Electrolysis: Figure 3, Rice University, <https://opentextbc.ca/chemistry/chapter/17-7-electrolysis/975>. Used under a Creative Commons Attribution 4.0 International Licence <https://creativecommons.org/licenses/by/4.0/>

Question 20

Adapted from Fig. 17.3 in OpenStax, <https://openstax.org/books/chemistry-2e/pages/17-2-galvanic-cells>.



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