

— Public use —

Sample assessment 2020

Multiple choice question book

Chemistry

Paper 1



Queensland
Government



Queensland Curriculum
& Assessment Authority

— Public use —

THIS PAGE IS INTENTIONALLY BLANK

— Public use —

Section 1

Instructions

- Answer all questions in the question and response book.
 - This book will not be marked.
-

QUESTION 1

In an open chemical system

- (A) energy but not matter is exchanged with the surrounds.
- (B) matter but not energy is exchanged with the surrounds.
- (C) both matter and energy are exchanged with the surrounds.
- (D) neither energy nor matter is exchanged with the surrounds.

QUESTION 2

An increase in the amount of branching in the structure of polyethene

- (A) increases its density and thus increases its melting point.
- (B) decreases its density and thus increases its melting point.
- (C) increases its density and thus decreases its melting point.
- (D) decreases its density and thus decreases its melting point.

QUESTION 3

Which of the following is an example of a redox reaction?

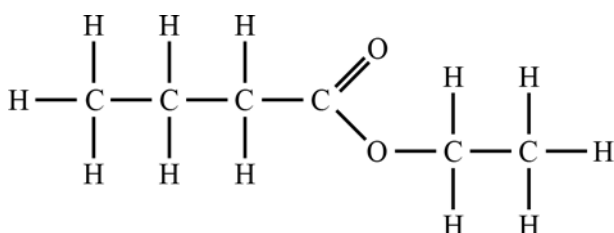
- (A) $\text{HCl(aq)} + \text{NaOH(aq)} \rightarrow \text{NaCl(aq)} + \text{H}_2\text{O(l)}$
- (B) $2\text{AgNO}_3\text{(aq)} + \text{Na(s)} \rightarrow \text{NaNO}_3\text{(aq)} + 2\text{Ag(s)}$
- (C) $\text{AgNO}_3\text{(aq)} + \text{NaCl(aq)} \rightarrow \text{NaNO}_3\text{(aq)} + \text{AgCl(aq)}$
- (D) $\text{HCl(aq)} + \text{Na}_2\text{CO}_3\text{(aq)} \rightarrow \text{NaCl(aq)} + \text{CO}_2\text{(g)} + \text{H}_2\text{O(l)}$

QUESTION 4

A carbohydrate is formed when

- (A) glucose molecules are joined by glycosidic bonds.
- (B) glucose molecules are joined by peptide bonds.
- (C) amino acids are joined by glycosidic bonds.
- (D) amino acids are joined by peptide bonds.

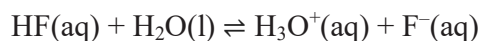
QUESTION 5



What is the IUPAC name for the molecule above?

- (A) butyl ethanoate
- (B) ethyl butanoate
- (C) butyl ethanoic acid
- (D) ethyl butanoic acid

QUESTION 6



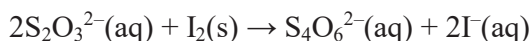
The equation above shows

- (A) the transfer of hydrogen ions between conjugate acid-base pairs.
- (B) the transfer of electrons between conjugate acid-base pairs.
- (C) the neutralisation of an acid to produce a conjugate base.
- (D) the neutralisation of an amphoteric species in solution.

— Public use —

QUESTION 7

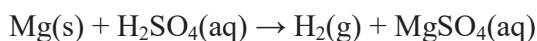
Identify the oxidising agent in the following redox reaction.



- (A) $\text{I}^-(\text{aq})$
- (B) $\text{I}_2(\text{s})$
- (C) $\text{S}_4\text{O}_6^{2-}(\text{aq})$
- (D) $\text{S}_2\text{O}_3^{2-}(\text{aq})$

QUESTION 8

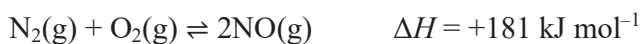
Calculate the atom economy for magnesium sulfate as the desired product in the following reaction.



- (A) 19.9%
- (B) 20.2%
- (C) 81.5%
- (D) 98.4%

QUESTION 9

Predict the effect that increasing temperature will have on the following reaction.

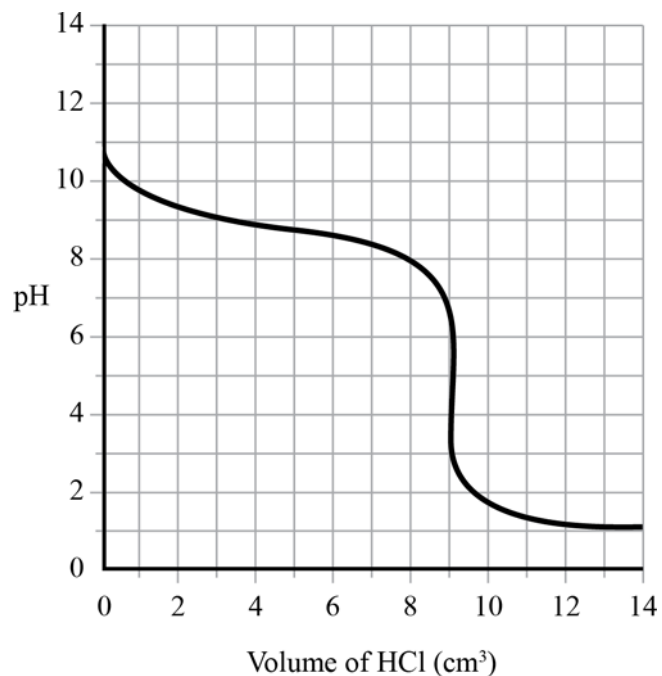


- (A) The equilibrium position will not change.
- (B) The equilibrium position will move towards the reactants (left).
- (C) The equilibrium position will move towards the products (right).
- (D) It is impossible to predict the effect on the equilibrium position.

— Public use —

QUESTION 10

The graph below shows the pH changes during the titration of 10.0 cm^3 of a weak base with $0.10 \text{ mol dm}^{-3} \text{ HCl}$.



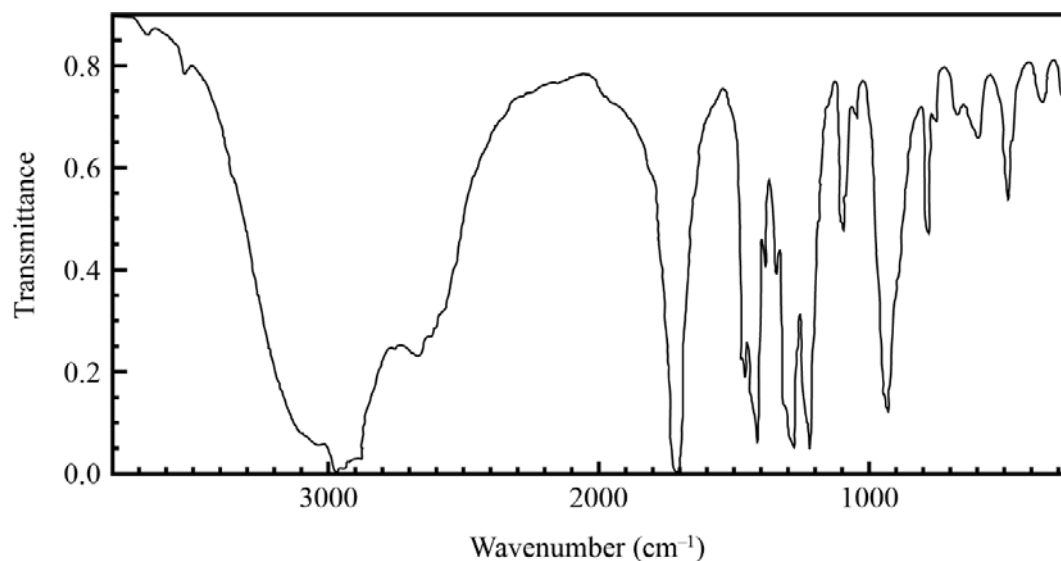
The initial concentration of OH^- ions in the weak base is

- (A) 10.5 mol dm^{-3}
- (B) 3.5 mol dm^{-3}
- (C) $10^{-3.5} \text{ mol dm}^{-3}$
- (D) $10^{-10.5} \text{ mol dm}^{-3}$

— Public use —

QUESTION 11

Analyse the infrared spectrum below to determine the functional groups present and the homologous series of the molecule in the sample.



	Functional group	Homologous series
(A)	C=O and O-H	ester
(B)	C-C and O-H	alcohol
(C)	C-C and C=O	aldehyde
(D)	C=O and O-H	carboxylic acid

QUESTION 12

The equation for the production of nitrous oxide, $2\text{N}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{N}_2\text{O}(\text{g})$, shows a high atom economy because

- (A) all the atoms in the reactants are converted to the desired product.
- (B) three molecules of reactant produce two molecules of product.
- (C) two diatomic molecules are combined to form a compound.
- (D) two different reactants are combined to form one product.

— Public use —

QUESTION 13

Which of the following undergoes a condensation reaction with an amine to form an amide?

- (A) an alcohol
- (B) an aldehyde
- (C) a carboxylic acid
- (D) a ketone

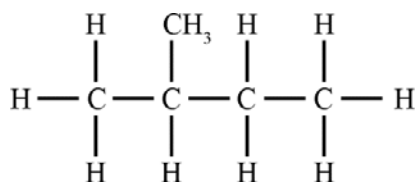
QUESTION 14

Deduce the oxidation state of nitrogen in NO_3^- .

- (A) -5
- (B) -3
- (C) $+3$
- (D) $+5$

QUESTION 15

Deduce which of the following is an isomer of the compound shown in the figure below.

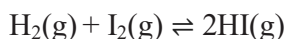


- (A) 1,2-dimethylpropane
- (B) 2,2-dimethylpropane
- (C) 2-methylbutane
- (D) 3-methylbutane

— Public use —

QUESTION 16

Deduce the correct equilibrium law expression for the following reaction.



- (A) $K_c = \frac{[\text{HI}]^2}{[\text{H}_2][\text{I}_2]}$
- (B) $K_c = \frac{[\text{H}_2][\text{I}_2]}{[\text{HI}]^2}$
- (C) $K_c = \frac{[\text{H}_2]^2[\text{I}_2]^2}{[\text{HI}_2]}$
- (D) $K_c = \frac{[\text{HI}_2]}{[\text{H}_2]^2[\text{I}_2]^2}$

QUESTION 17

Identify the organic compound below that reacts with acidified potassium dichromate(VI) to produce a colour change from orange to green.

- (A) $(\text{CH}_3)_3\text{COH}$
- (B) CH_3COOH
- (C) CH_3COCH_3
- (D) $\text{CH}_3\text{CH}(\text{OH})\text{CH}_3$

QUESTION 18

Determine the relative strength of the following oxidising agents (from strongest to weakest) by comparing standard electrode potentials for the metal ions forming their respective metals.

- (A) $\text{Cu}^{2+} > \text{Fe}^{2+} > \text{Pb}^{2+}$
- (B) $\text{Fe}^{2+} > \text{Pb}^{2+} > \text{Cu}^{2+}$
- (C) $\text{Pb}^{2+} > \text{Fe}^{2+} > \text{Cu}^{2+}$
- (D) $\text{Cu}^{2+} > \text{Pb}^{2+} > \text{Fe}^{2+}$

QUESTION 19

Determine the pH of a 0.15 M solution of hydrochloric acid (HCl).

- (A) 0.15
- (B) 0.71
- (C) 0.82
- (D) 1.41

— Public use —

QUESTION 20

The melting point of alkanes increases as the number of carbon atoms in the parent chain increases because the

- (A) number of protons increases and therefore the strength of the intermolecular forces decreases.
- (B) number of protons increases and therefore the strength of the intermolecular forces increases.
- (C) number of electrons increases and therefore the strength of the intermolecular forces decreases.
- (D) number of electrons increases and therefore the strength of the intermolecular forces increases.

QUESTION 21

In molecular manufacturing, mechanosynthesis (or the orientation effect) produces molecules with specific properties by

- (A) adding or substituting specific atoms in a structure.
- (B) positioning desired functional groups so they align in molecules.
- (C) adding a protective group that prevents functional groups from reacting.
- (D) manipulating the bonding that occurs between atoms, ions and molecules.

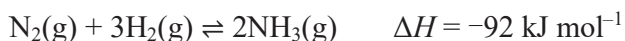
QUESTION 22

Which of the following acids can be classified as monoprotic?

- (A) H_3PO_4
- (B) H_2CO_3
- (C) $\text{H}_2\text{C}_2\text{O}_4$
- (D) CH_3COOH

QUESTION 23

The Haber process combines nitrogen and hydrogen to produce ammonia as shown in the reaction below.



Which of the following conditions favours the formation of the highest yield of ammonia from an equilibrium mixture of nitrogen and hydrogen?

- (A) high temperature and high pressure
- (B) high temperature and low pressure
- (C) low temperature and high pressure
- (D) low temperature and low pressure

— Public use —

QUESTION 24

The table below shows the K_a value for several weak acids.

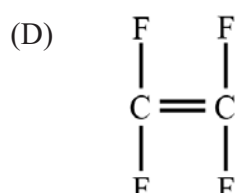
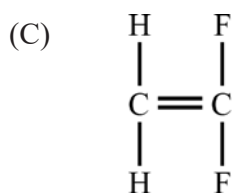
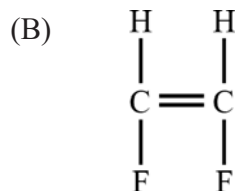
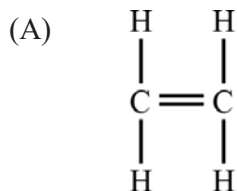
Acid	K_a (20 °C)
Acetic acid	1.8×10^{-5}
Chlorous acid	1.1×10^{-2}
Nitrous acid	4.0×10^{-4}
Phosphoric acid	7.5×10^{-3}

Which acid dissociates to form the strongest conjugate base at equilibrium in an aqueous solution?

- (A) acetic acid
- (B) chlorous acid
- (C) nitrous acid
- (D) phosphoric acid

QUESTION 25

Which of the following monomers undergoes polymerisation to form polytetrafluorethene?



— Public use —

References

NIST Chemistry WebBook 2017, *Butanoic acid*, <https://webbook.nist.gov/cgi/cbook.cgi?ID=C107926&Units=SI&Type=IR-SPEC&Index=1#IR-SPEC>, viewed on 15 July 2018.

— Public use —

THIS PAGE IS INTENTIONALLY BLANK

— Public use —