

CHEMISTRY

VCE Unit 3 Mid-year examination

EXAM 1

9 Practice Examinations

2008–2011

A+ Practice Exams
graduated difficulty with solutions

A+

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CHEMISTRY

EXAM 1 VCE Unit 3

Detailed Information

Test	Time (min)	Details of the Key Skills and Knowledge covered by each test
1	45	Chemical equations, redox half-equations, mole concept, stoichiometric calculations, gas laws, flame test analysis, isomers, empirical formula & organic chemicals
2	45	pH, redox equations, gas laws, acid–base chemistry, mole concept, stoichiometric calculations, volumetric analysis, chromatography, organic chemistry
3	60	pH, gas laws, standard solutions, chromatography, volumetric analysis, significant figures, redox equations, atomic absorption spectroscopy, oxidation numbers, emission spectroscopy, organic chemistry
4	60	Significant figures, errors, chromatography, stoichiometric calculations, colorimetric analysis, volumetric analysis, oxidation numbers, functional group organic chemistry, analytical instrumentation
5	60	Volumetric analysis, analytical instrumentation, ethene chemistry, chromatography, stoichiometric calculations, organic chemical reactions
6	60	pH, ethene, stoichiometric calculations, gas laws, atomic absorption spectrophotometer, gravimetric analysis, organic chemistry reaction pathways
7	60	Gas laws, volumetric analysis (back titration), stoichiometric calculations, pH, esters, analytical instrumentation, biochemical fuels
8	90	Analysis, crude oil, stoichiometric calculations, volumetric analysis (back titration), gravimetric analysis, mole concept, esters, analytical instrumentation, triglycerides, protein structures
9	90	Detachable examination

Collectively these 9 practice tests provide almost 10 hours of structured preparation.

Section A: Multiple-choice questions**Specific instructions to students**

- A correct answer scores 1 mark, and an incorrect answer scores 0.
- Marks are not deducted for incorrect answers.
- No marks are given if more than one letter is shaded on the answer sheet.
- Choose the alternative that most correctly answers the question and mark your choice on the multiple-choice answer section at the bottom of each page as shown in the example below.

1 A B C 

- Use pencil only.
- Working space is provided under those questions that require working out.

QUESTION 1

A molecule of a monounsaturated fatty acid contains 16 carbon atoms. The number of hydrogen atoms in one molecule of this acid is:

- A** 29
B 30
C 31
D 32

QUESTION 2

Chemical bonding is an integral feature of the various structural levels in a protein molecule. Which of the following correctly matches structural level with bonding type?

Structural level	Bonding type
A primary	covalent
B primary	hydrogen
C secondary	covalent
D secondary	ionic

QUESTION 3

The pH of a solution containing a H_3O^+ concentration of $0.0001 \text{ mol L}^{-1}$ is:

- A** 4
B 1
C 10^{-4}
D -4

QUESTION 4

The product of the addition polymerisation reaction between ethene molecules using a metal oxide catalyst under moderately high pressure would be:

- A** CH_3CH_3
B HDPE
C CH_2CH_2
D $\text{CH}_2\text{ClCH}_2\text{Cl}$

QUESTION 5

Sulfuric acid is a strong acid. A student spills some on their clothing and skin. The immediate response should be:

- A** to wash with sodium hydroxide solution.
B to rinse with sodium carbonate solution.
C to wash with water.
D to neutralise with litmus.

QUESTION 6

To identify the type of substance observed in a high performance gas chromatogram, a chemist would:

- A** measure the total area under the various peaks.
B determine the separation distance between the peaks.
C compare with a standard sample run immediately prior to the unknown sample.
D measure the approximate time taken for the chromatogram to finish.

QUESTION 7

In the reaction $\text{CH}_3\text{CH}_2\text{CH}=\text{CH}_2 \xrightarrow{\text{H}_2/\text{Pt}}$, the catalytic hydrogenation using Pt as a catalyst results in the formation of:

- A butane.
- B hexane.
- C butadiene.
- D cyclobutane and hydrogen.

QUESTION 8

Ethene when reacted with HBr, using AlCl_3 as a catalyst, yields:

- A bromoethene.
- B dibromoethane.
- C bromoethane.
- D chloroethane.

QUESTION 9

A low resolution ^1H NMR spectrum contains 3 peaks. The peaks indicate that:

- A the molecule contains a CH_2 group.
- B the molecule contains a CH_3 group.
- C there are 3 hydrogen atoms in the molecule.
- D there are three different environments for the hydrogen atoms.

QUESTION 10

In an analysis of the quality of water, various ions are detected. The most suitable analytical instrument from the list below for the detection of magnesium ions would be:

- A a gas chromatograph.
- B a high-performance liquid chromatograph.
- C a UV-visible spectrophotometer.
- D an atomic absorption spectrometer.

ONE ANSWER PER LINE				USE PENCIL ONLY					
1	<input type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D	6	<input type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D
2	<input type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D	7	<input type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D
3	<input type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D	8	<input type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D
4	<input type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D	9	<input type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D
5	<input type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D	10	<input type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D

Section B: Short-answer questions**Specific instructions to students**

- This section consists of 9 short-answer questions.
- Answer all of the questions in the spaces provided.
- To receive full credit for an answer, you should:
 - give simplified answers with an appropriate number of significant figures to all numerical questions; unsimplified answers will not be given full credit
 - show all working in your answers to numerical questions. No credit can be given for an incorrect answer unless it is accompanied by details of workings
 - make sure that chemical equations are balanced and that the formula for individual substances include indications of their state, e.g. $\text{H}_2\text{CO}_3(\text{aq})$.

QUESTION 1

8 marks

Draw and name all of the isomers that are alcohols with a structural formula of $\text{C}_4\text{H}_9\text{OH}$.

Answer:

QUESTION 2

1 + 1 + 1 + 1 + 3 + 3 + 5 = 15 marks

An atomic absorption spectrometer is an instrument used for the analysis of chemical components.

a What substances does this instrument detect?

Answer:

b At what concentrations can these substances be detected?

Answer:

- c** The flame in this instrument plays an integral part in the analysis of the substances. What gases are used to produce the flame?

Answer:

- d** In what phase are the samples introduced?

Answer:

- e** *Atomiser* is a term used in conjunction with this instrument. What does it refer to?

Answer:

- f** The lamp used is specific to the substance being analysed. Describe how this lamp is used.

Answer:

- g** Draw a flow chart of how the instrument is constructed and label the main components.

Answer:

QUESTION 3

2 + 4 = 6 marks

A reaction mixture contains 5.0 gram of AgNO_3 and 25.0 gram of CaCl_2 dissolved in water.

- a** Write a balanced chemical equation for the reaction.

Answer:

- b** Calculate the number of grams of AgCl that can be formed.

Answer:

QUESTION 4

4 marks

- a** When analysing an infrared spectrum, what is the unit used for the frequency of the radiation?

Answer:

- b** Consider the propan-1-ol molecule, $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$. Where would the $-\text{OH}$ peak be found on the IR spectrum?

Answer:

QUESTION 5

2 + 2 + 2 = 6 marks

Give concise explanations for the following observations.

- a** Hydrocarbon molecules are insoluble in water.

Answer:

- b** Gaseous hydrocarbon molecules are volatile and flammable.

Answer:

c Hydrocarbon molecules do not conduct electricity.

Answer:

QUESTION 6 2 + 1 + 1 + 2 + 2 + 2 = 10 marks

An impure sample of FeS of mass 0.85 gram was analysed. The FeS was dissolved in HCl and the resulting H₂S produced reacted with a dilute solution of AgNO₃. The precipitate of Ag₂S produced was filtered off, washed and gently dried. The mass of Ag₂S produced was 1.32 grams.

a Write a balanced equation for the reaction of the FeS(s) with HCl(aq). Assume the products to be in an aqueous state.

Answer:

b Write a balanced equation for the reaction of H₂S with the AgNO₃ solution.

Answer:

c Write an ionic equation for part b.

Answer:

d Calculate the amount (in mol) of Ag₂S produced.

Answer:

e Calculate the amount (in mol) of FeS in the sample.

Answer:

f Calculate the percentage purity of the sample.

Answer:

QUESTION 7

4 + 1 = 5 marks

a It is found experimentally that 0.563 gram of a vapour at 100°C and 725 mmHg has a volume of 265 mL. Calculate the relative molecular mass for the gas.

Answer:

b Suggest the name of the gas if it is known to be a halogen.

Answer:

QUESTION 8

3 marks

Explain why the petroleum refining industries and the manufacturing of polymers are usually located close together.

Answer:
