
CHEMISTRY VCE UNITS 1&2 DIAGNOSTIC TOPIC TESTS 2007

TEST 8: GASES

TOTAL 35 MARKS (45 MINUTES)

Student's Name: _____ Teacher's Name: _____

Directions to students

Write your name and your teacher's name in the spaces provided above.
Answer all questions in the spaces provided.

SECTION A: MULTIPLE-CHOICE QUESTIONS

Instructions for Section A

For each question in Section A, choose the response that is correct and circle your choice.
Choose the response that is **correct** or **best answers** the question.
A correct answer scores 1, an incorrect answer scores 0.
Marks will **not** be deducted for incorrect answers.
No marks will be given if more than one answer is completed for any question.

Question 1

Which of the following is **not** a greenhouse gas?

- A. CO_2
- B. H_2O
- C. CH_4
- D. N_2

Question 2

At a certain temperature and pressure, 0.10 g of hydrogen gas occupies a volume of 0.625 L.

Under these conditions the molar volume of the gas is

- A. 6.25 L
- B. 12.5 L
- C. 22.4 L
- D. 24.5 L

Question 3

Which of the following describes the process of nitrogen fixation?

- A. Interconversion of soluble nitrogen-containing ions such as NH_4^+ and NO_3^- .
- B. Conversion of N_2 molecules to soluble nitrogen-containing ions such as NH_4^+ and NO_3^- .
- C. Return of N_2 molecules to the air from the soil.
- D. Breakdown of nitrogen-containing wastes by soil bacteria.

Question 4

A balloon filled with helium gas at 20°C has a pressure of 621 mmHg. The balloon is moved to an area with a temperature of 15°C and atmospheric pressure of 500 mmHg.

The volume of the balloon will

- A. increase by approximately 25%.
- B. increase by approximately 35%.
- C. decrease by approximately 25%.
- D. decrease by approximately 35%.

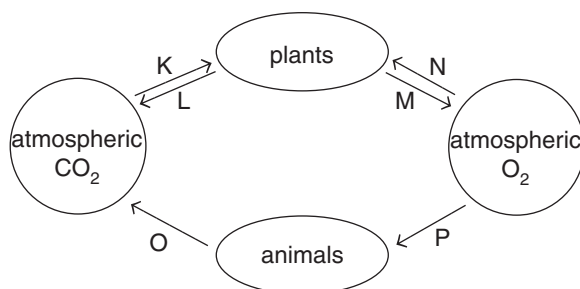
Question 5

The number of nitrogen molecules present in the air in a $4\text{ m} \times 4\text{ m} \times 2\text{ m}$ room at SLC is closest to

- A. 6.3×10^{26}
- B. 6.9×10^{26}
- C. 7.9×10^{26}
- D. 8.6×10^{26}

Questions 6 and 7 refer to the following information.

The diagram below shows a simple carbon–oxygen cycle. The arrows labelled K to P show the movement of gases in and out of plants and animals.



Question 6

Which two arrows (K to P) show the overall movement of gases in and out of an actively growing plant over a 24-hour period?

- A. K and M
- B. K and L
- C. N and M
- D. N and L

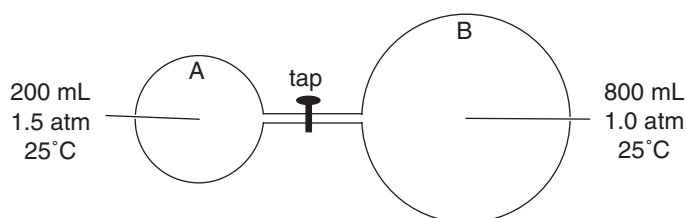
Question 7

Which arrow could represent the process of fermentation by a single-celled organism?

- A. K
- B. L
- C. M
- D. P

Question 8

Consider the gases contained in the arrangement shown below.



If the gaseous contents of vessel A are forced into vessel B, the total pressure in vessel B at 25°C will now be closest to

- A. 0.4 atm.
- B. 1.0 atm.
- C. 1.4 atm.
- D. 1.9 atm.

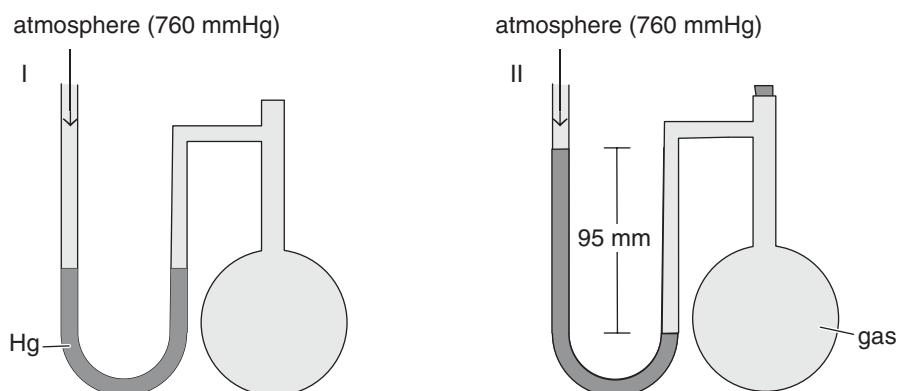
Question 9

The Kyoto Protocol of 1997 has as its major aim the

- A. reduction of emissions of acid rain forming gases.
- B. minimisation of the release of chemicals that contribute to photochemical smog.
- C. decrease of greenhouse gas emissions.
- D. limitation of production of chlorofluorocarbons (CFCs).

Question 10

The open-tube manometer is a device for measuring gas pressure. When open to the atmosphere, the mercury levels are equal (diagram I below). When a gas filled flask is connected to the manometer, the mercury levels are as shown in diagram II.



Which of the following shows the pressure of the gas in the flask in diagram II?

- | | Pressure (mmHg) | Pressure (atm) |
|----|-----------------|----------------|
| A. | 665 | 0.875 |
| B. | 665 | 1.14 |
| C. | 855 | 0.889 |
| D. | 855 | 1.13 |

SECTION B: SHORT-ANSWER QUESTIONS

Instructions for Section B

Answer **all** questions in the spaces provided.

To obtain full marks you should

- give simplified answers with an appropriate number of significant figures to all numerical questions; unsimplified answers will not be given full marks.
- show all working in your answers to numerical questions. No credit will be given for an incorrect answer unless it is accompanied by details of the working.
- make sure chemical equations are balanced and that the formulas for individual substances include an indication of state; for example $\text{H}_2(\text{g})$; $\text{NaCl}(\text{s})$.

Question 1

Give a concise explanation for each of the following observations.

- a. Gases behave more ideally at high temperatures and low pressures.

2 marks

- b. Unpolluted rainwater is naturally acidic.

2 marks

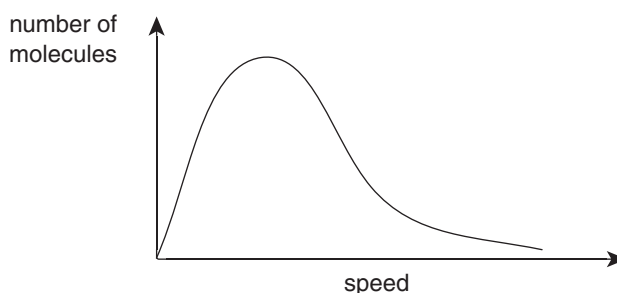
- c. Ozone is toxic to both plants and animals, yet ozone is vital to the survival of life on Earth.

2 marks

Total 6 marks

Question 2

The graph below shows the distribution of speeds of gaseous molecules for a gas sample in a container of fixed volume.



a. Indicate whether the following characteristics increase, decrease or remain unchanged when the gas sample is heated.

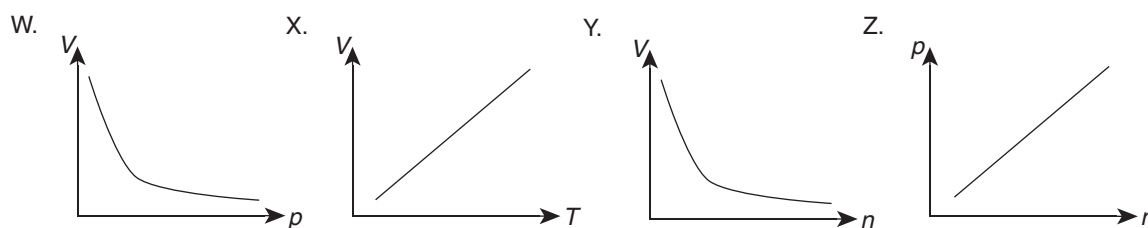
i. Pressure exerted by the gas in the container.

ii. Area under the curve on the distribution of speeds graph.

iii. Average kinetic energy of the gas molecules.

1 + 1 + 1 = 3 marks

b. The graphs below show possible relationships between the various characteristics of gases: pressure (p), temperature (T), volume (V) and amount of gas (n). Select from these graphs (W to Z) when answering the following questions.



i. Which graph represents Charles' Law?

ii. Which graph does **not** represent the expected behaviour of an ideal gas?

1 + 1 = 2 marks

- c. Listed below are a number of reactions.
- combustion of methane
 - aerobic respiration
 - incomplete combustion of coal (carbon)
 - photosynthesis
 - denitrification
 - addition of magnesium to dilute acid
 - addition of copper(II) oxide to dilute acid

i. From the list above, select a reaction which produces carbon monoxide gas.

ii. From the list above, select a reaction which removes oxygen gas from the atmosphere.

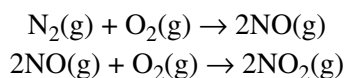
iii. From the list above, select a reaction which produces hydrogen gas.

1 + 1 + 1 = 3 marks

Total 8 marks

Question 3

Vehicle exhaust fumes contain small amounts of the nitrogen oxides, NO and NO₂. These are formed during the reactions shown by the equations



a. In a laboratory experiment, 20 mL of NO and 20 mL of O₂ were allowed to react at constant temperature and pressure.

What volume of gas would remain after reaction was complete?

2 marks

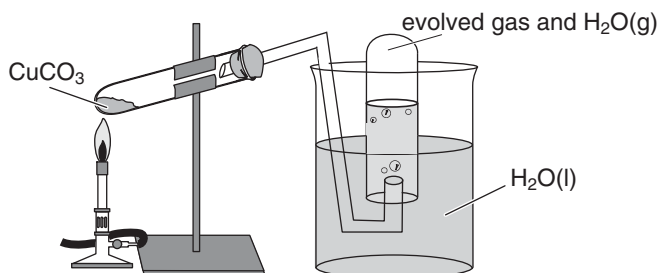
b. Describe one environmental problem that the emission of nitrogen oxides from vehicles contributes to. Include a balanced chemical equation where relevant.

2 marks

Total 4 marks

Question 4

A sample of copper(II) carbonate was heated in a test tube. The gas evolved was collected over water, as shown in the diagram below.



0.621 L of gas was collected at a temperature of 22.0°C and a total pressure of 762 mmHg. Water vapour pressure at 22.0°C is 21.0 mmHg.

- a. Write a balanced equation for the gas-producing reaction.

_____ 1 mark

- b. Calculate

- i. the partial pressure of the evolved gas in the collected gas.

- ii. the amount (in mol) of gas evolved.

- iii. the mass of CuCO₃ decomposed to evolve the gas.

1 + 2 + 2 = 5 marks

- c. Measurements of the mass of CuCO₃ before and after heating showed that the mass decomposed was greater than the value calculated in **b.iii.**

Suggest why the calculated value is significantly lower than expected.

1 mark
Total 7 marks