
CHEMISTRY VCE UNITS 1&2 DIAGNOSTIC TOPIC TESTS 2007

TEST 5: WATER AND AQUEOUS SOLUTIONS

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 property of water?

- A. Water readily dissolves many ionic salts.
- B. Water always boils at 100°C.
- C. Water has a relatively high surface tension.
- D. Water is colourless and odourless.

Question 2

Which of the following alternatives contains only water soluble substances?

- A. Potassium chloride (KCl), sand (SiO₂), ammonia (NH₃).
- B. Sodium nitrate (NaNO₃), glucose (C₆H₁₂O₆), hydrogen chloride (HCl).
- C. Barium hydroxide (Ba(OH)₂), salt (NaCl), ethane (C₂H₆).
- D. Iron(II) oxide (FeO), ethene (C₂H₄), ethanol (C₂H₅OH).

Question 3

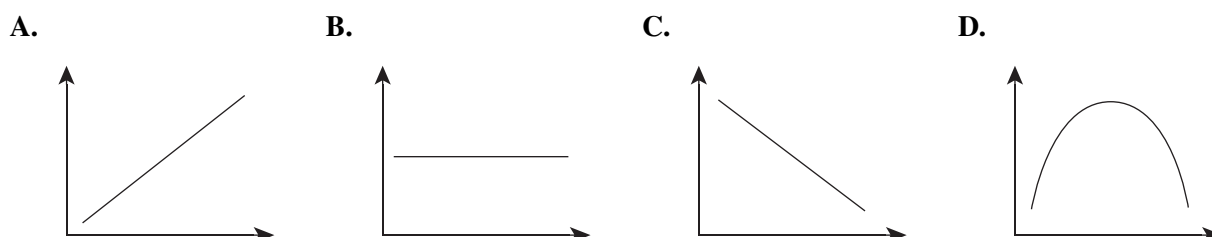
According to the label on the bottle, the vitamin C content of a fruit juice drink is 0.13 g per 200 mL.

Which of the following concentrations is **not** equivalent to this concentration?

- A. 0.65 g L^{-1}
- B. $0.065\% \text{ m/v}$
- C. 65 ppm
- D. 0.65 mg mL^{-1}

Question 4

Which of the graphs below best represents the change in solubility of carbon dioxide in water with increasing pressure?



Question 5

Which of the following compounds is likely to be present as a solid when aqueous solutions of barium nitrate ($\text{Ba}(\text{NO}_3)_2$) and sodium sulfate (Na_2SO_4) are mixed?

- A. $\text{Ba}(\text{NO}_3)_2$
- B. Na_2SO_4
- C. NaNO_3
- D. BaSO_4

Question 6

The concentration of chloride ion in 250.0 mL of solution containing 52.9 g of aluminium chloride (AlCl_3) is

- A. 0.212 M.
- B. 0.396 M.
- C. 1.59 M.
- D. 4.76 M.

Question 7

Which of the following does **not** occur during the desalination process using flash distillation?

- A. Energy is used to force water to move by diffusion from an area of high salt concentration to an area of low salt concentration.
- B. Water is boiling at reduced atmospheric pressure in order to lower its boiling temperature.
- C. Water and salt are separated based on the difference in their boiling points.
- D. Pure water is collected as water vapour condenses.

Questions 8 to 10 refer to the following information.

The solubility of silver nitrate (AgNO_3) in water at 50°C is 455 g per 100 g of water.

Question 8

786 g of AgNO_3 is stirred into 150 g of water in a beaker and then heated to 50°C .

The beaker will contain

- A. an unsaturated solution of AgNO_3 .
- B. a saturated solution of AgNO_3 with no undissolved solid.
- C. a saturated solution of AgNO_3 with 103 g of undissolved solid.
- D. a saturated solution of AgNO_3 with 125 g of undissolved solid.

Question 9

The mass of AgNO_3 dissolved in 300 g of a saturated solution of AgNO_3 at 50°C is

- A. 152 g.
- B. 246 g.
- C. 455 g.
- D. 1365 g.

Question 10

During a practical class, a student was asked to determine the solubility of AgNO_3 in water at 30°C . The student was instructed to dissolve as much AgNO_3 as possible in 50 g of water in a 100 mL beaker at a temperature of 30°C . The result obtained was higher than the expected value.

Which of the following could account for the higher than expected value?

- A. The water temperature in the beaker was 20°C , not 30°C .
- B. An 80 mL beaker was used instead of a 100 mL beaker.
- C. 55 g of water was used, not 50 g.
- D. The student did not stir the solution adequately.

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

- a. Describe one example of the application of, or importance to life of, each of the following properties of water.

- i. Water has a high surface tension.

- ii. Water expands as it freezes.

- iii. Water has a high heat of vaporisation.

1 + 1 + 1 = 3 marks

- b. Write balanced ionic equations for the overall reaction which occurs when the following aqueous solutions are mixed.

- i. Magnesium chloride (MgCl_2) and potassium hydroxide (KOH) solutions are mixed and a gelatinous white precipitate forms.

- ii. A yellow precipitate forms when solutions of lead(II) nitrate ($\text{Pb}(\text{NO}_3)_2$) and sodium iodide (NaI) are mixed.

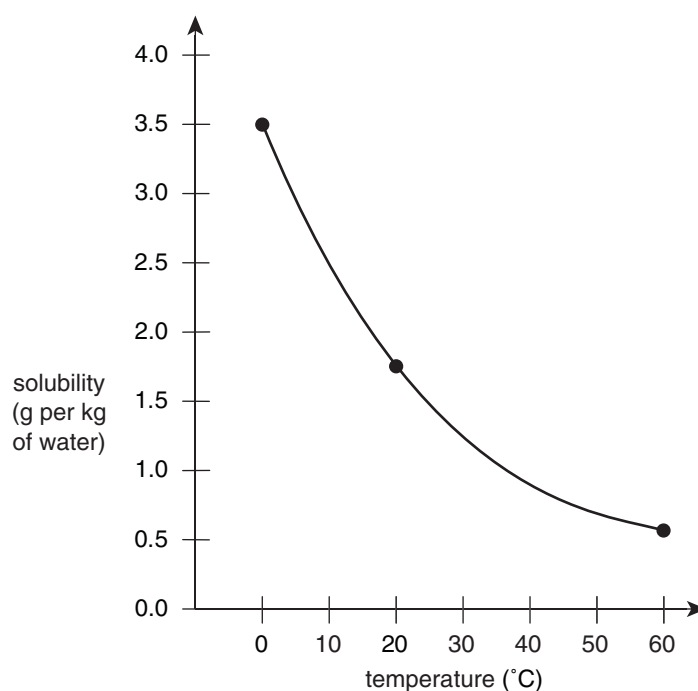
1 + 1 = 2 marks

- c. Explain why ammonia (NH_3) is soluble in water, while methane (CH_4) is insoluble in water.

2 marks
Total 7 marks

Question 2

- a. The graph below shows the solubility of carbon dioxide in water as temperature varies.



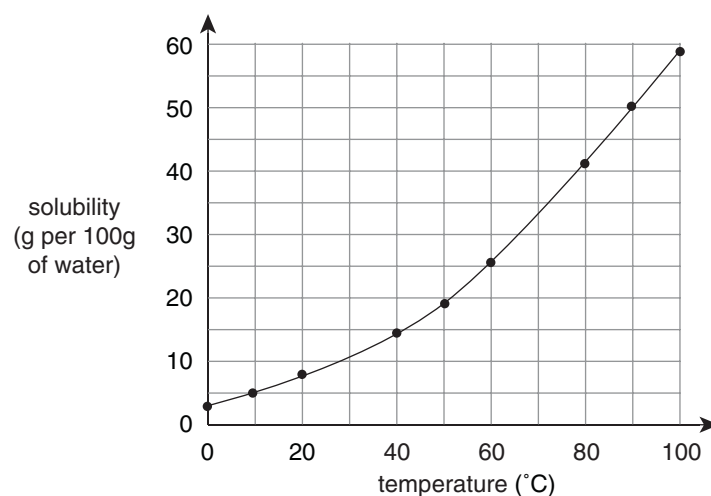
An open beaker holds 1500 g of water saturated with carbon dioxide at 20°C. The beaker is heated to 60°C.

- i. What mass of carbon dioxide would be expected to be lost from the beaker?

- ii. The actual loss in mass of the beaker and contents is greater than the value calculated in part a.i. Suggest why.

2 + 1 = 3 marks

- b.** The solubility of potassium chlorate (KClO_3) at different temperatures is shown in the graph below.



- i.** At 40°C , a solution contains 10 g of KClO_3 completely dissolved in 50 g of water.
Which of the terms 'saturated', 'supersaturated' and 'unsaturated' would be used to describe this solution?

- ii.** Approximately what mass of KClO_3 crystals will be deposited when 50 mL of a saturated solution of KClO_3 is cooled from 90°C to 40°C ?

1 + 2 = 3 marks
Total 6 marks

Question 3

Lithium chloride (LiCl) is a white crystalline solid which dissolves in water.

- a. i.** Write a chemical equation to show the dissociation of solid LiCl when it dissolves in water.

- ii.** Name the type of bonds which must be broken if crystals of LiCl are to dissolve.

- iii.** Using a diagram, show the bonds that form between a dissociated lithium ion and neighbouring water molecules in the LiCl solution. Name any bond types present.

1 + 1 + 2 = 4 marks

- b.** Glucose (C₆H₁₂O₆) is also a white crystalline solid which dissolves in water.

Describe a laboratory test which could be used to distinguish between a solution of LiCl and a solution of C₆H₁₂O₆. Include the expected results of the test.

2 marks

Total 6 marks

Question 4

- a.** A toothpaste contains 0.32% w/w NaF.

What mass of fluoride (F^-) is present in a 120 g tube of this toothpaste?

2 marks

- b.** A particular vodka contains 35% v/v ethanol, while a particular white wine contains 11% v/v ethanol.
What volume of the vodka contains the same volume of ethanol as a 250 mL glass of the white wine?

2 marks

- c.** What mass of solute is required to prepare 250.0 mL of 0.150 M $CuSO_4$ solution?

2 marks

Total 6 marks