Neap:

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 (SiO_2), ammonia (NH_3).

B. Sodium nitrate ($NaNO_3$), glucose ($C_6H_{12}O_6$), hydrogen chloride (HCl).

C. Barium hydroxide ($Ba(OH)_2$), salt (NaCl), ethane (C_2H_6).

D. Iron(II) oxide (FeO), ethene (C_2H_4), ethanol (C_2H_5OH).

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% m/v

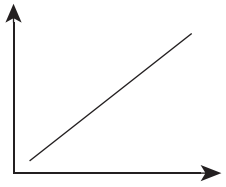
C. 65 ppm

D. 0.65 mg mL^{-1}

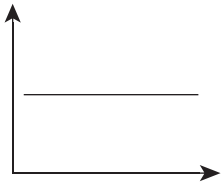
Question 4

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

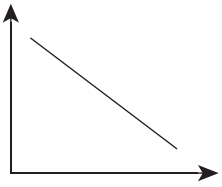
A.



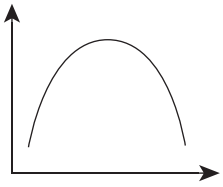
B.



C.



D.



Question 5

Which of the following compounds is likely to be present as a solid when aqueous solutions of barium nitrate ($Ba(NO_3)_2$) and sodium sulfate (Na_2SO_4) are mixed?

A. $Ba(NO_3)_2$

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 $H_2(g)$; NaCl(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 ($Pb(NO_3)_2$) 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.

_____

_____

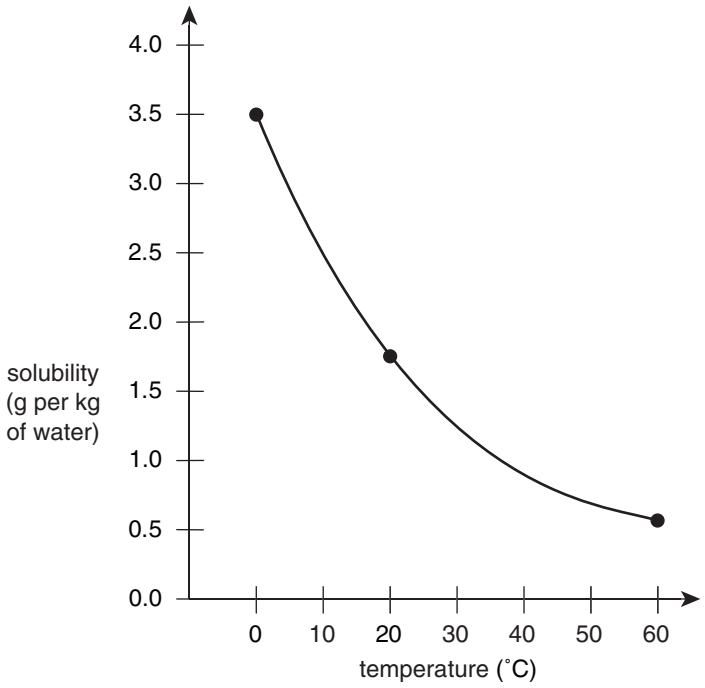
_____

_____

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?

_____

_____

_____

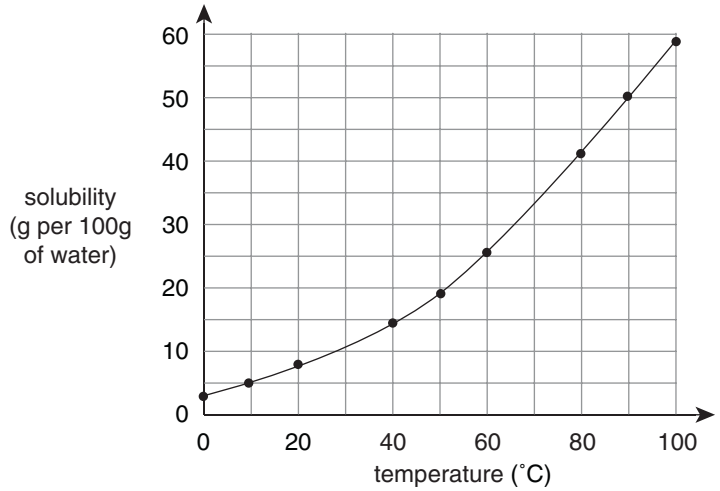
_____

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 ($C_6H_{12}O_6$) 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 $C_6H_{12}O_6$. 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