

**Test 4 2015**

**Solutions**

**Question/Answer Booklet**

**CHEMISTRY**

**Stage 2**

|  |  |
| --- | --- |
| **Student Name** |  |

|  |  |
| --- | --- |
| **Section** | **Mark** |
| One | /20 |
| Two | /32 |
| Total | /52 |
| % | |

**Answers**

**Time allowed for this paper**

Working time for paper:

**Material required/recommended for this paper**

***To be provided by the supervisor***

This Question/Answer booklet

Multiple-choice Answer sheet

Chemistry Data sheet

***To be provided by the candidate***

Standard items: pens (blue/black preferred), pencils (including coloured), sharpener, correction fluid/tape, eraser, ruler, highlighters

Special items: non-programmable calculators approved for use in the WACE examinations

**Important note to candidates**

No other items may be taken into the examination room. It is **your** responsibility to ensure that you do not have any unauthorised notes or other items of a non-personal nature in the examination room. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

**Section One: Multiple-choice (20 marks)**

This section has **10** questions. Answer **all** questions on the separate Multiple-choice Answer Sheet provided.

1. Increasing the temperature of the solvent
2. Increases the solubility of solid, liquid and gaseous solutes
3. Decreases the solubility of gaseous solute
4. Affects the solubility of solid solutes only.
5. Decreases the solubility of solid solutes.
6. What mass of NaCl is needed to prepare 500 mL of a 4 M NaCl solution?
7. 117 g
8. 2.00 g
9. 58.5 g
10. 4.00 g
11. A student adds 6.00 g of a solid to 30.0 mL of water. What is the concentration of this solution expressed as mass/mass percent?

(Assume the density of water to be 1 g/ml).

1. 0.167 % (m/m)
2. 0.200 % (m/m)
3. 16.7 % (m/m)
4. 20.0 % (m/m)
5. What are the concentrations of all species present in an aqueous solution of 0.15 M K3PO4? (square brackets mean ‘concentration’)
6. [K+] = 0.45 M and [PO43-] = 0.15 M
7. [K+] = 0.15 M and [PO43-] = 0.45 M
8. [K+] = 0.15 M and [PO43-] = 0.15 M
9. [K+] = 0.45 M and [PO43-] = 0.45 M
10. A bottle of white wine contains 12.5% alcohol by mass. What would be the mass of alcohol contained in a 150 mL glass of wine, assuming the density of the wine is 1.00 g/mL?

1. 8.33 g
2. 0.188 g
3. 18.8 g
4. 9.48 g
5. Which of the following has the greater number of moles of Na+
6. 20mL of 0.105 mol L-1 NaCl
7. 200mL of 0.010 mol L-1 Na2CO3
8. 20mL of 1.050 mol L-1 Na3PO4
9. 2 L of 0.010 mol L-1 NaCl
10. 15mL of 0.75M H2SO4 is transferred into a 125mL flask and then diluted with distilled water. The concentration in mol L-1 of the diluted solution is:
11. 0.125M
12. 0.500 M
13. 2.00 M
14. 0.090M
15. Lead sulfate can be described as:
16. strong electrolyte
    1. weak electrolyte
    2. strong conductor
    3. weak conductor
17. i and iii
18. i and iv
19. ii and iii
20. ii and iv
21. 1.325g of sodium carbonate is dissolved in water and a 250mL solution is made. The concentration of the solution is:
22. 0.55 mol L-1
23. 0.50 mol L-1
24. 5.00 mol L-1
25. 0.05 mol L-1
26. Which of the following pairs of solutions would precipitate when mixed together?
27. Barium chloride and sodium nitrate
28. Copper chloride and sodium sulphate
29. Silver nitrate and Sodium chloride
30. Iron(II) sulphate and potassium nitrate

**PART B: EXTENDED ANSWER AND CALCULATIONS (30 MARKS)**

**Question 1 (8 marks)**

The solubility curves below show the change in solubility of a number of ionic compounds in water with a rise in temperature.

Use the graph to answer the following questions.

Potassium nitrate

Potassium chloride

Solute per 100g of H2O (g)

50

Sodium chloride

Copper (II) sulfate

Potassium chlorate

10

0

100

50

Temperature (oC)

1. What can you infer about the relationship between temperature and solubility of ionic compounds in water? (1)

**The solubility of compounds increases with temperature.**

1. Which of the compounds shown is the most soluble at 10.0°C? **…NaCl..** (1)
2. Which compound is the most soluble at 40.0°C? **KNO3…………………….** (1)
3. Estimate the extra mass of copper sulfate that could be dissolved in 100 mL water at 80.0°C, if 15g of copper sulfate has already been dissolved. (2)

**At 800C approximately 32-33g of copper sulfate is soluble in 100 mL of water. This would mean that an extra 17-18g of copper sulphate could be dissolved in the solution.**

1. Would an aqueous solution of 45g potassium nitrate in 100 mL water be saturated at 40.0C? Justify your answer. (3)

**No. (1)**

**The graph shows that 50g of potassium nitrate is soluble in 100 mL of water at 40C. (1)**

**An extra 5g of potassium nitrate can be added before the solution is**

**saturated. (1)**

**Question 2 (6 marks)**

Using sodium chloride and hydrogen chloride as examples, explain the similarities and differences between ‘ionisation’ and ‘dissociation’. You must provide equations in your answer.

**Similarity: both substances produce ions (1) in solution and**

**are strong electrolytes (1)**

**Differences:**

**NaCl is an ionic substance (1) and will dissociate into its ions in solution (1)**

**HCl is covalent, but a strong acid (1), will completely ionise (1)**

**Question 3 (8 marks)**

For the following determine:

1. The concentration of the resulting solution when 60.50 grams of CuSO4 is dissolved in 250mL of water. (3)

**n (CuSO4) = 60.5/159.62 = 0.37903 mol (1)**

**c = n/V = 0.37903/0.25 = 1.5 mol L-1 (1)**

**mol L-1 (1) must have correct units for extra mark**

1. The final concentration when 25.0mL of 12 mol L-1 HCL is diluted with water

to give a final volume of 100.0 mL. (2)

**C1 x V1 = C2 x V2**

**C2 = C1 x V1/V2 = 12 x 25/100 = 3.0 (1)**

**mol/L (1) must have correct units for extra mark**

1. The mass of potassium carbonate required to prepare 150.0 ml of

0.250 mol L-1 solution. (3)

**C = n/V therefore n = c x V 0.25 mol/L x 0.15 L (1)**

**nK2CO3 = 0.0375 mol (1)**

**mK2CO3 = n x M = 0.0375 x 138.21 = 5.18 g (1)**

**must have correct units for full marks**

**Question 4 (4 marks)**

**1 mark for powerpack/source of electricity**

**1 mark for electrodes**

**1 mark for electrolyte**

**1 mark for light bulb/ammeter**

**Question 5 (4 marks)**

0.200 moles of solid MgCl2 are added to a 1.20 L of 1.40 mol L–1 NaCl solution.

Calculate the concentration, in mol L–1, of Cl– ions in the ‘new’ solution after both the solutions are combined.

n(Cl–) from MgCl2 = 0.400 mol **(1)**

1. *n*(Cl–) from NaCl = *c*V
2. = 1.40 × 1.20

= 1.680 mo l **(1)**

1. total amount of Cl– = 2.08 mol in a

volume of 1.20 L **(1)**

1. concentration of Cl*–* =
2. =
3. = 1.73 mol L–1 **(1)**