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VCE Chemistry ½

Solubility & Precipitation [1.9]

Test Solutions

20 Marks. 1 Minute Reading. 16 Minutes Writing.

Results:

Quiz Questions	_____ / 15
Extension	_____ / 5

Section A: Quiz Questions (15 Marks)

Question 1 (4 marks)

Tick whether the following statements are **True** or **False**.

	True	False
a. Sodium is fully positive whereas the hydrogen of a water molecule is only partially positive on that end.	✓	
b. An ion-dipole bond occurs when an ion forms covalent bonds with the dipole of another molecule.		✓
c. Covalent bonding is an example of an intramolecular bond whereas dispersion forces are an example of an intermolecular bond.	✓	
d. Hydrogen bonds are the strongest type of intermolecular force.		✓
e. If a solution is aqueous, it means that there has been some solute dissolved into water.	✓	
f. Sodium ethanoate is a non-soluble substance, and due to this, it will form a precipitate if added to a container of water.		✓
g. AgCl is an example of an insoluble compound, due to having stronger forces of attraction between the individual Ag and Cl ions, than between the ions and water molecules.	✓	
h. Water and oil are miscible with each other, as oil floats at the top.		✓

Space for Personal Notes

Question 2 (7 marks)

Lead iodide is an insoluble chemical compound that can be produced from the combination of lead nitrate and potassium iodide, as shown in the equation below.

$$Pb(NO_3)_2\,(aq) + 2KI\,(aq) \rightarrow PbI_2\,(s) + 2KNO_3\,(?)$$

a. What is the meaning of the (aq) symbol as compared to the (s) symbol? (1 mark)

(aq) means that it has been dissolved in water whereas (s) means it solid.

b. Explain how potassium iodide is soluble in water, with reference to the relevant intramolecular and intermolecular bonds. (2 marks)

The ionic bonds that hold that hold the potassium and iodine atoms together are weaker than the ion-dipole bonds that form between potassium/water and iodine/water. Due to this the KI particles separate causing them to dissociate in water.

c. Given that a chemist wanted to use the lead iodide produced from this reaction, how could it be separated from the solution? (1 mark)

It would fall to the bottom, so the solution could be drained to take the solid.

d. Is KNO_3 soluble or insoluble in water? (1 mark)

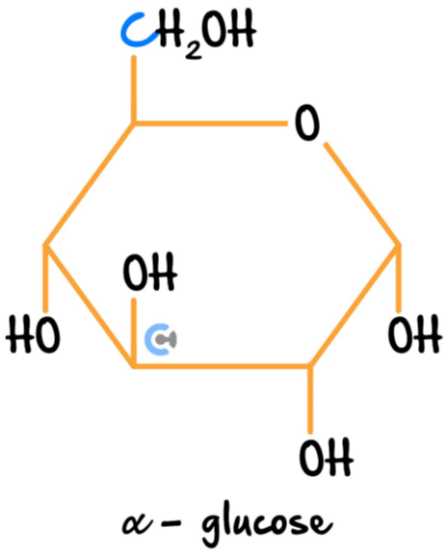
Soluble as it is nitrate.

e. Explain with reference to the intramolecular bonds, why PbI_2 is insoluble in water. (2 marks)

Pb and I atoms are held together very strongly by electrostatic forces in a lattice. These electrostatic forces are stronger than the ion-dipole bonds that form between Pb/I and water, meaning that they do not dissolve.

Question 3 (4 marks)

Below is a molecule of glucose. In the lab, Harry takes a spoonful of glucose and places it into a beaker full of vegetable oil. However, he notices that after stirring it, the glucose does not dissolve. Harry makes sure to note this observation into his practical book to investigate further at a later time.



a. With reference to the structure of glucose and its polarity, explain the observation which Harry noted. (2 marks)

Glucose is a polar molecule due to the presence of the OH groups which are polar. Vegetable oil on the other hand is non-polar (can figure this out by knowing that oil and water don't mix). Due to this they can not mix with one another.

b. What intermolecular forces would form between this glucose molecule and water? Thus, would glucose be soluble in water? (1 mark)

Hydrogen bonds - Yes.

c. Describe the intramolecular forces which are present within the glucose molecule. (1 mark)

Covalent bonds.

Section B: Extension (5 Marks)

Question 4 (5 marks)

Calcium carbonate is a dietary supplement taken by individuals when the amount of calcium in the diet is not enough. In a dry form, it can be found as a white powder. $Ca^{2+}(aq)$ ions produce a yellow-grey colour in solutions.

a. Write the complete balanced chemical equation to show the formation of calcium carbonate through the reaction between calcium chloride and sodium carbonate. (1 mark)

$$CaCl_2\ (aq)\ +\ Na_2CO_3\ (aq)\ \rightarrow\ CaCO_3(s)\ +\ 2NaCl\ (aq)$$

b. What observation would a chemist be able to make to know that the calcium has been converted from its reactant form to its final product form? Explain with reference to solubility and dissolution of ionic compounds. (3 marks)

$CaCl_2$ is a soluble ionic compound. When dissolved in water, the Ca^{2+} ions exist in an aquous form producing a yellow-grey color in the solution. However, when $CaCO_3$ is produced, the Ca^{2+} now exists in a solid form, and is no longer soluble. Thus the solution loses its previous color, and instead a white precipitate begins to settle at the bottom of the solution.

c. Provide the ionic equation for this reaction. (1 mark)

$$Ca^{2+}(aq) + {CO_3}^{2-}(aq) \rightarrow CaCO_3(s)$$

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