Cambridge Lower Secondary Science
Chapter 2: Properties of Materials (Solutions & Dissolving)

Teacher's Answer Key

Section 1: Multiple Choice Questions

Select the single best answer for each question by circling the correct letter.

1. What do we call the solid substance that dissolves into a liquid?

A. Solvent
B. Solution
C. Solute
D. Mixture

Answer: C

2. Which of the following liquids is opaque and therefore NOT a true solution?

A. Copper sulfate in water
B. Milk
C. Saltwater
D. Sugar dissolved in black tea

Answer: B

3. A student dissolves 15 g of salt into 50 g of water. What is the total mass of the resulting solution?

A. 50 g
B. 15 g
C. 65 g
D. Mass cannot be determined

Answer: C

4. What term describes a solution in which absolutely no more of the solid will dissolve?

A. Dilute
B. Soluble
C. Saturated
D. Concentrated

Answer: C

5. Which process requires two substances (a solute and a solvent) to occur?

A. Melting
B. Freezing
C. Boiling
D. Dissolving

Answer: D

6. In a scientific investigation, what do we call the variable that you intentionally choose to change?

A. Dependent variable
B. Independent variable
C. Control variable
D. Anomalous variable

Answer: B

7. When drawing a graph of your experimental results, where should the independent variable be placed?

A. On the vertical axis (y-axis)
B. On the horizontal axis (x-axis)
C. It does not matter
D. In the title

Answer: B

8. How does temperature generally affect the solubility of most solid solutes in water?

A. Solubility decreases as temperature increases
B. Temperature has no effect on solubility
C. Solubility increases as temperature increases
D. The solute becomes insoluble

Answer: C

9. Which of the following statements about a dilute solution is true?

A. It contains more solute particles than a concentrated solution.
B. It contains fewer solute particles than a concentrated solution.
C. No more solute can dissolve in it.
D. It is always completely colourless.

Answer: B

10. What is paper chromatography used for?

A. To melt solid substances
B. To conserve the mass of a solution
C. To separate and identify substances in a sample
D. To measure the temperature of a solvent

Answer: C

Section 2: Fill in the Blanks

Complete the following sentences with the correct scientific terms.

11. When sugar dissolves in water, the sugar particles spread out among the water particles, forming a uniform mixture called a **Solution**.

12. All true solutions are **Transparent**, which means you can see light clearly through them.

13. During the process of dissolving, no mass is lost; scientists say the mass has been **Conserved**.

14. A solid, such as iron filings, that will not dissolve in water is described as **Insoluble**.

15. If a solution has a very high number of solute particles dissolved in the solvent, it is described as a **Concentrated** solution.

16. The variable that you measure in an experiment (such as the mass of salt dissolved) is called the **Dependent** variable.

17. To ensure a fair test, you must keep certain conditions exactly the same; these are called **Control** variables.

18. When planning a solubility investigation using temperature, the gap you choose between your temperatures (e.g., 10°C, 20°C, 30°C) is known as the **Interval**.

19. Candle wax turning to liquid as a candle burns is an example of **Melting**, not dissolving.

20. In an experiment, if you measure temperatures from 10°C up to 80°C, this spread of temperatures is known as your **Range**.

Section 3: True or False

State whether each statement is True or False. If False, briefly explain why on the lines provided.

21. When a sugar cube is dissolved in water, the sugar particles disappear and no longer exist. **False**

Answer: The sugar particles do not disappear; they simply spread out among the water particles and become too small to see.

22. A transparent solution can still have a colour, like blue copper sulfate. **True**

23. Melting butter in a hot frying pan is a chemical example of dissolving. **False**

Answer: Melting requires only one substance (butter) and heat. Dissolving requires two substances (a solute and a solvent).

24. If 9 g of salt is dissolved in 50 g of water, the final mass of the solution will be exactly 59 g. **True**

25. A saturated solution can dissolve plenty of additional solute if you stir it without heating it. **False**

Answer: A saturated solution is one where absolutely no more solid will dissolve at that temperature.

26. Scientists often measure the solubility of a solute by finding out how many grams will dissolve in exactly 100 g of water. **True**

27. When plotting a graph of your results, the dependent variable is always placed on the vertical axis. **True**

28. Sodium chloride and sugar are both examples of insoluble substances. **False**

Answer: Sodium chloride and sugar are soluble in water.

29. To compare the solubility of two different salts fairly, you must use the same volume and type of solvent. **True**

30. As water particles vibrate and slide past one another, they bump into solid sugar particles, which helps separate them during dissolving. **True**

Section 4: Matching

Match the items in Column A with their correct descriptions in Column B by writing the correct letter on the line.

31. The Dissolving Process

1. Solute	B	A. The mixture formed
2. Solvent	C	B. The solid that is dissolving
3. Solution	A	C. The liquid doing the dissolving

32. Visual Properties of Liquids

1. Transparent	C	A. Cannot see through it (like milk)
2. Opaque	A	B. Looks like pure water with no hue
3. Colourless	B	C. Can see through it (even if it has a hue)

33. Solution Types

1. Concentrated	C	A. Contains very few solute particles
2. Dilute	A	B. Cannot dissolve any more solute
3. Saturated	B	C. Contains a large number of solute particles

34. Identifying Variables

1. Independent	C	A. The condition you measure
2. Dependent	A	B. The condition kept the same
3. Control	B	C. The condition you intentionally change

35. Scientific Processes

1. Melting	C	A. Requires two substances to mix
2. Dissolving	A	B. Separates and identifies substances in a sample
3. Paper Chromatography	B	C. Requires only one substance and heat

Section 5: Short Answer Questions

Provide a brief, accurate answer for each question on the lines provided.

36. Explain the difference between the terms “transparent” and “opaque” when describing liquids.

Answer: A transparent liquid allows you to see through it (like a solution). An opaque liquid blocks light and you cannot see through it (like milk).

37. Use particle theory to explain what happens to the tightly packed particles of a sugar crystal when it is placed in water.

Answer: The water particles vibrate and slide past one another, bumping into the sugar particles. This movement separates the sugar particles until they are mixed completely with the water particles.

38. Why is it scientifically incorrect to say that salt “disappears” when it is mixed into water?

Answer: Because the mass of the sugar is still present. The sugar particles have just separated and spread out among the water particles, becoming too small to see.

39. Write the simple word equation that proves mass is conserved during dissolving.

Answer: Mass of solute + mass of solvent = mass of solution.

40. Define the term “solubility” as it is commonly measured in a science laboratory.

Answer: Solubility measures how much of a solute will dissolve in a known amount of solvent (usually 100 g of water) at a specific temperature.

41. State the difference between an “insoluble” solid and a “soluble” solid, giving one example of an insoluble solid.

Answer: A soluble solid will dissolve in water (e.g., sugar). An insoluble solid will not dissolve in water (e.g., iron filings).

42. Why does stirring a mixture help a solute dissolve faster?

Answer: Stirring increases the movement of the particles, helping the solvent particles bump into and separate the solute particles much faster.

43. If a student is investigating how the volume of water affects how much salt can dissolve, name two control variables they must keep the same.

Answer: They must control the temperature of the water and the type of salt used.

44. Explain why the solubility of most solid solutes increases when the solvent is heated.

Answer: Heating gives the particles more energy, causing them to move and vibrate more rapidly, which helps separate the solute particles more efficiently.

45. In paper chromatography, why do different substances in a mixture separate into distinct spots as the solvent moves up the paper?

Answer: Because the different substances have different solubilities. The more soluble substances are carried further up the paper by the solvent than the less soluble ones.

Section 6: Application & Data Interpretation

Apply your scientific knowledge to solve these specific scenarios. Show your working where appropriate.

46. Data Calculation: The solubility of sodium chloride is 36 g in 100 g of water at 20°C. Exactly how much sodium chloride would dissolve in just 50 g of water at 20°C? Show your working.

Answer: 50 g is half of 100 g, so exactly half the amount of sodium chloride will dissolve: 36 g / 2 = 18 g.

47. Data Calculation: If 204 g of sugar can dissolve in 100 g of water at 20°C, how much sugar will dissolve in 200 g of water at 20°C? Show your working.

Answer: 200 g is twice the amount of 100 g, so exactly twice the amount of sugar will dissolve: 204 g × 2 = 408 g.

48. Graph Analysis: A student plots a line graph showing the temperature of water on the x-axis and the mass of dissolved copper sulfate on the y-axis. One of the plotted points sits far away from the smooth trend of the line. What is the scientific term for a result that does not fit the pattern?

Answer: An anomalous result (or a result that does not fit the pattern).

49. Experimental Design Flaw: Marcus wants to compare the solubility of Salt A and Salt B. He dissolves Salt A in 50 cm^3 of hot water, and Salt B in 100 cm^3 of cold water. Explain why his results will be invalid.

Answer: Because he did not control his variables. To be a fair test, he must use the exact same volume of water AND the exact same temperature of water for both salts.

50. Application: A food scientist places a spot of black ink from a child's candy packaging onto chromatography paper and places it in a solvent. After 10 minutes, there are three distinct spots on the paper (red, yellow, and blue). What does this prove about the black ink?

Answer: It proves that the black ink is not a pure element or pure compound, but rather a mixture of different coloured substances.