

## MACROSCOPIC PROPERTIES OF MATTER 11

- Which of the following is NOT an example of a homogeneous substance?
  - carbon dioxide gas
  - a solution of copper(II) sulfate
  - air
  - molten lead
  - a mixture of oil and water
  
- Which of the following contains only pure substances?
  - molten iron, oxygen gas, water
  - molten iron, an aqueous solution of copper(II) chloride
  - Salt, nitrogen gas, copper(II) nitrate solution
  - Sodium, lead and sodium nitrate solution
  - Carbon dioxide gas, nitrogen gas, air
  
- A student is required to separate a mixture of charcoal and salt. Of the following alternatives, which one best summarizes the method which would allow the separation and retention of both components of the mixture?
  - addition of water, decantation, filtration
  - addition of water, filtration, crystallization
  - addition of water, decantation, crystallization
  - addition of water, distillation
  - addition of water, decantation, distillation
  
- When a solution of lead nitrate is added to a solution of sodium iodide, an insoluble yellow precipitate of lead iodide is formed. Of the following the BEST way of separating the lead iodide from the solution would be
  - evaporation.
  - distillation.
  - filtration.
  - crystallization.
  - decantation.

The following diagram represents the apparatus used for filtration.

Refer to page 2 of hard copy for diagram.

5. The correct names for labels A and B respectively are
- a) filtrate and distillate
  - b) crystals and residue
  - c) filtrate and residue
  - d) residue and filtrate
  - e) residue and distillate
6. Which of the following statements is NOT consistent with the kinetic theory of gases?
- a) Any two gases at the same temperature will have the same average kinetic energy
  - b) The molecules of a gas move in random, straight line motion, colliding with the walls of their container and each other
  - c) The average distance between gas molecules is large compared to the relatively small size of the molecules themselves.
  - d) There is some loss of energy as gas molecules collide because these collisions are not perfectly elastic.
  - e) When the molecules within a gas come into close contact there are no attractive or repulsive forces between them.
7. Which of the following will cause an increase in the average kinetic energy of a gas?
- a) Increasing the pressure of the gas.
  - b) Decreasing the pressure of the gas.
  - c) Increasing the volume of the container housing the gas.
  - d) Increasing the temperature of the gas.
  - e) Adding more gas particles to the system.

The next two questions refer to the graph below, which shows the vapour pressure and temperature relationship for water and an unknown substance X.

Refer to page 3 of hard copy for diagram.

8. What is the normal boiling point of Substance X?
- a) 100°C                      b) 150°C  
c) 40°C                        d) 60°C
9. At normal atmospheric pressure ( approximately 101.3 kPa), the boiling point of water is 100°C. Use the graph to predict the boiling point of water on Mt. Everest where the atmospheric pressure would only be 35 kPa.
- a) 75°C                        b) 100°C  
c) 60°C                        d) 80°C
10. Consider equal volumes of hydrogen and oxygen gas at the same conditions of temperature and pressure. Which of the following statements is FALSE?
- a) The molecules have the same average kinetic energy.  
b) The molecules of hydrogen would have a greater average velocity than those of oxygen.  
c) The molecules of hydrogen and oxygen would have the same average velocity.  
d) Oxygen molecules have greater molecular mass than hydrogen molecules.  
e) The kinetic energy of the gas molecules is a function of both the masses and velocities of the molecules.

11. Molar Heat of Fusion refers to
- the amount of energy released when a mole of a substance undergoes combustion.
  - the amount of heat released during nuclear fusion of one mole of a substance.
  - the amount of heat required to boil one mole of a substance at its boiling point.
  - the amount of heat released when one mole of a substance changes phase from a gas to a liquid.
  - the amount of heat required to melt one mole of a substance at its melting point.
12. The table below shows the molar heats of fusion and vapourization of five common substances.

Substance	molar heat of fusion (kJ mol <sup>-1</sup> )	molar heat of vapourization (kJ mol <sup>-1</sup> )
Hydrogen	0.1	0.4
Methane	1	8
Water	6	41
Ammonia	6	23
Sodium chloride	28	170

Which of the following, lists these substances in order of *increasing* boiling point?

- Sodium chloride, water, ammonia, methane and hydrogen.
  - Hydrogen, methane, ammonia, water and sodium chloride.
  - Hydrogen, methane, water, ammonia and sodium chloride.
  - Methane, hydrogen, water, ammonia and sodium chloride.
13. Boyle's Law states that:
- The pressure exerted by a given mass of gas at constant volume is directly proportional to the absolute temperature of that gas.
  - The volume and absolute temperature of a gas are directly proportional.
  - The pressure exerted by a given mass of gas at constant temperature is inversely proportional to the volume occupied by the gas.
  - The pressure exerted by a given mass of gas at constant temperature is directly proportional to the volume of the gas.

14. Which of the graphs below shows the relationship between the pressure and volume of a gas at constant temperature?

Refer to page 5 of hard copy for diagram.

15. Convert  $-30^{\circ}\text{C}$  to Kelvin.

- a) 303 K                      b) 60 K  
c) 243 K                      d) 130 K

16. A gas syringe contains 50 mL of oxygen at  $30^{\circ}\text{C}$ . To what temperature must it be heated to cause the gas volume to double?

- a)  $60^{\circ}\text{C}$                       b)  $333^{\circ}\text{C}$   
c) 303 K                      d) 333 K

17. Calcium reacts with water as shown:



What volume of hydrogen would be liberated at STP when 16 g of calcium reacts with excess water?

- a) 16 L                      b) 22.4 L  
c) 10.5 L                      d) 8.96 L

18. Which ONE of the following would NOT occur when the pressure of a given mass of gas at constant temperature is increased?
- a) The number of collisions between the gas molecules and the walls of their container increases.
  - b) The average kinetic energy of the molecules increases.
  - c) The volume of the gas decreases.
  - d) The number of gas molecules remains the same.
19. A 500 mL sample of nitrogen gas is collected over water at 20°C and 105 kPa. The vapour pressure of water at 20°C is 2.34 kPa. What is the partial pressure of the nitrogen gas at 20°C?
- a) 497.66 kPa
  - b) 102.66 kPa
  - c) 105 kPa
  - d) 500 kPa
20. Which of the following is NOT true about Absolute Zero?
- a) Absolute Zero is equal to 0°C.
  - b) At Absolute Zero, an ideal gas would not occupy any space.
  - c) At Absolute Zero, the molecules of a gas have no kinetic energy.
  - d) Absolute Zero is equal to -273°C.
21. The following diagram represents two bulbs containing gases connected by a valve.

Refer to page 6 of hard copy for diagram.

Bulb A has a volume of 3L and contains nitrogen gas at 200 mm pressure. Bulb B has a volume of 5 L and contains oxygen gas at 400 mm pressure. If the valve is open to allow mixing of the two gases, what would be the partial pressure of the oxygen in the mixture?

(Temperature remains constant)

- a) 250 mm
- b) 200 mm
- c) 300 mm
- d) 600 mm

**The next FOUR questions are based on the following information.**

In a laboratory exam, a student was given FOUR unlabelled test tubes containing solutions of sodium bromide, sodium iodide, sodium nitrate and sodium carbonate. The student was provided with *labelled* solutions of lead nitrate and calcium nitrate and told to use these to correctly identify which solutions were in the four test tubes. The results obtained by the student are summarized in the table below. Using your knowledge of solubility rules, interpret these results to answer the next four questions.

	Test tube 1	Test tube 2	Test tube 3	Test tube 4
<b>Addition of 10 drops of Pb(NO<sub>3</sub>)<sub>2</sub></b>	White precipitate	No reaction	Yellow precipitate	White precipitate
<b>Addition of 10 drops of Ca(NO<sub>3</sub>)<sub>2</sub></b>	No reaction	No reaction	No reaction	White precipitate

22. Which test tube contained the sodium nitrate?
- a) 1                                      b) 2  
c) 3                                      d) 4
23. Which test tube contained the sodium bromide?
- a) 1                                      b) 2  
c) 3                                      d) 4
24. Which test tube contained the sodium iodide?
- a) 1                                      b) 2  
c) 3                                      d) 4
25. Which test tube contained the sodium carbonate?
- a) 1                                      b) 2  
c) 3                                      d) 4

26. A small amount of salt when added to a salt solution, dissolves. From this we can conclude that the original salt solution was
- concentrated.
  - dilute.
  - saturated.
  - unsaturated.
27. A saturated solution is one in which
- there is more solvent than solute.
  - there are equal amounts of solvent and solute.
  - no more solute can be dissolved in the solution at that temperature.
  - solute particles cannot be seen
28. Which one of the following pairs of solutions, when mixed, would NOT produce a precipitate?
- Magnesium nitrate and sodium sulfate.
  - Sodium chloride and silver nitrate.
  - Magnesium nitrate and barium hydroxide.
  - Barium nitrate and Potassium sulfate.
29. What is the concentration (in  $\text{mol L}^{-1}$ ) of a silver nitrate solution which is made by dissolving 10.79 g of silver nitrate in 500 mL of solution?
- $0.1 \text{ mol L}^{-1}$
  - $0.02 \text{ mol L}^{-1}$
  - $0.2 \text{ mol L}^{-1}$
  - $0.05 \text{ mol L}^{-1}$
30. Which of the following solutions would be the best conductor of electricity?
- $0.1 \text{ mol}^{-1}$  hydrochloric acid.
  - $0.1 \text{ mol}^{-1}$  ethanoic acid.
  - $0.1 \text{ mol}^{-1}$  sodium chloride
  - $0.1 \text{ mol}^{-1}$  magnesium chloride.
31. Which one of the following contains *only* strong electrolytes?
- Sodium chloride, water and sulfuric acid.
  - Magnesium hydroxide, ammonia and potassium chloride.
  - Ethanoic acid, ammonia and water.
  - Magnesium hydroxide, sodium chloride and potassium nitrate.



32. Concern has been expressed by environmentalists that global warming could severely affect aquatic life by causing a decrease in the amount of oxygen in the water. Which of the following statements would explain such a decrease in oxygen?
- a) The solubility of a gas increases with increased temperature.
  - b) The solubility of a gas decreases with increased temperature.
  - c) The solubility of oxygen would decrease due to the presence of other toxic gases
  - d) The increased concentration of carbon dioxide will displace oxygen in the water.
33. Deep-sea divers use compressed (pressurized) oxygen gas when diving. They must be careful when returning to the surface to prevent a condition called the 'bends'. This is when bubbles of nitrogen gas form in the bloodstream and body fluids, interfering with normal functioning of the nervous system. The *best* explanation for the formation of these nitrogen bubbles is that
- a) the solubility of nitrogen gas decreases with increasing pressure.
  - b) the solubility of nitrogen gas decreases with increased temperature.
  - c) the solubility of the nitrogen gas in the blood and body fluids decreases with decreasing pressure.
  - d) the solubility of nitrogen gas is not affected by temperature.