

Replacement Test: Multiple Choice

SCH3AE 00-01

1. When a chlorine atom becomes a chloride ion the:
- Ion has the same diameter as the atom
 - Ion has a smaller diameter than the atom
 - Ion has a larger diameter than the atom
 - Nucleus becomes larger
 - Nucleus becomes smaller
2. 20 mL of a gaseous hydrocarbon require 90 mL of oxygen gas for complete combustion, both volumes being measured under the same conditions of temperature and pressure. Which one of the following is the hydrocarbon?
- a. CH₄ b. C₂H₂ c. C₂H₄ d. C₃H₆ e. C₃H₈
3. The new element Canadium has two isotopes, ³⁰⁰Cn and ³¹⁰Cn with relative abundances of 25% and 75% respectively. The relative atomic mass of Canadium is:
- a. 302.5 b. 305.0 c. 307.5 d. 309.0
4. What would be the mass of 0.200 mol of sulfuric acid?
- a. 19.60 g b. 9.70 g c. 9.80 g d. 8.10 g e. 8.20 g
5. A sample of a compound contains only 9.0 g of hydrogen and 36 g of carbon. The simplest formula for the compound is:
- a. C₄H b. C₃₆H₆ c. CH₂ d. CH₃ e. C₂H₄
6. The molar mass of a hypothetical element X is 25 g/mol. It is found that 50.0 g of X combine with 32.0 g of oxygen. What is the simplest formula for the oxide of X?
- a. X₂O b. XO₂ c. X₂O₃ d. XO e. XO₄
7. Sulfur (S₈) reacts with oxygen (O₂) and produces sulfur trioxide (SO₃) according to the following balanced equation:
- $$\text{S}_8(\text{s}) + 12 \text{O}_2(\text{g}) \Rightarrow 8 \text{SO}_3(\text{g})$$
- How many moles of oxygen molecules must react to produce 160 g of sulfur trioxide?
- a. 3.00 b. 6.00 c. 9.0 d. 12.0
- Consider the following equation for the next question:
- $$\text{Fe}_3\text{O}_4 + 4 \text{H}_2 \Rightarrow 3 \text{Fe} + 4 \text{H}_2\text{O}$$
8. The number of moles of hydrogen required to completely react with 2.0 mol of (Fe₃O₄) is:
- a. 4 b. 6 c. 8 d. 12
9. Which element has the highest ionization energy?
- a. Na b. F c. Ne d. Cl e. Mg

The **next two questions** deal with the identification and characterization of three elements which we shall call X, Y, and Z. The elements have successive atomic numbers each increasing by one in the order given. Atoms of element Z form stable ions with the formula Z^+ .

10. Which of the following statements is FALSE concerning elements X, Y, and Z?
- A neutral atom of element Y would have one more electron than a neutral atom of element X, but one less electron than a neutral atom of element Z.
 - Element X could be a halogen.
 - Elements X, Y, and Z would all be in the same chemical family of the periodic table.
 - Elements X, Y, and Z could be those elements with atomic numbers 9, 10, and 11 respectively.
11. Which of the following statements is FALSE concerning the elements X, Y, Z and their ions?
- The ions X^- and Z^+ would have the same number of electrons as neutral atoms of element Y.
 - Atoms of element Y would react with either those of elements X or Z.
 - Element X would form a compound with hydrogen with the formula HX.
 - Element Z would form a compound with chlorine with the formula ZCl.
 - Elements X and Z would react to form a compound with the formula ZX.
12. 1 L of gas in a container at -73°C is allowed to expand to 1.5 L. What must the temperature be increased to so that the pressure remains constant?
- a. -36°C b. 0°C c. 27°C d. 73°C
13. During a chemical reaction which of the following statements is true?
- When one of the products of reaction is a gas the mass of the reactants will be greater than the mass of the products.
 - When of the products is a precipitate the mass of the products will be greater than the mass of the reactants.
 - The mass of the products is not dependant on the mass of the reactants.
 - The mass of the products equals the mass of the reactants.
14. A substance that changes the speed of a chemical reaction without being permanently altered is:
- a. A catalytic agent b. A dehydrating agent
c. An oxidizing agent d. A reducing agent
15. Which of the following principles of conservation apply in all chemical reactions having a balanced equation?
- conservation of volume
 - conservation of the number of molecules
 - conservation of the number of atoms
 - conservation of mass
- a. 1 – 2 – 3
b. 2 – 3 – 4
c. 3 – 4 only
d. 1 – 2 only
16. The pressure on 600 cm^3 of gas is increased from 100 kPa to 300 kPa at constant temperature. What will the new volume of gas be?
- a. 200 cm^3 b. 300 cm^3 c. 1200 cm^3 d. 1800 cm^3

17. Which of the following equations is not balanced?
- $\text{P}_4 + 5 \text{O}_2 \Rightarrow 2 \text{P}_2\text{O}_5$
 - $2 \text{NCl}_3 \Rightarrow \text{N}_2 + \text{Cl}_3$
 - $2 \text{H}_2\text{O} + 2 \text{K}_2\text{O}_2 \Rightarrow \text{O}_2 + 4 \text{KOH}$
 - $\text{PbS} + 4 \text{H}_2\text{O}_2 \Rightarrow \text{PbSO}_4 + 4 \text{H}_2\text{O}$
18. Which one of the following reactions is not possible?
- $\text{Na} \Rightarrow \text{Na}^+ + \text{e}^-$
 - $\text{F} \Rightarrow \text{F}^+ + \text{e}^-$
 - $\text{H}_2 \Rightarrow 2 \text{H}^+ + 2\text{e}^-$
 - $\text{Cl} \Rightarrow \text{Cl}^- + \text{e}^-$
 - $\text{Ba} \Rightarrow \text{Ba}^{2+} + 2\text{e}^-$
19. How many electrons are there in a sulphide ion, S^{2-} ?
- a. 14 b. 15 c. 16 d. 17 e. 18
20. A bromide ion will have a charge of:
- a. +1 b. +2 c. +3 d. -1 e. -2
21. An atom of iron $^{56}_{26}\text{Fe}$ has:
- 26 protons, 26 electrons, 30 neutrons
 - 30 protons, 30 electrons, 26 neutrons
 - 30 protons, 26 electrons, 26 neutrons
 - 26 protons, 26 electrons, 56 neutrons
 - 26 protons, 30 electrons, 30 neutrons
22. How many electrons are in the outer (highest) energy level of a $^{39}_{19}\text{K}$ ion?
- a. 3 b. 5 c. 6 d. 7 e. 8
23. 8.00 g of NaOH is dissolved in sufficient water to make 200.0 mL of solution. The concentration of the solution is (in mol/L):
- a. 1.00 b. 0.200 c. 0.250 d. 0.500 e. 0.040
24. The atom with an atomic number of 13 will tend to:
- gain 5 electrons
 - gain 3 electrons
 - lose 5 electrons
 - lose 3 electrons
 - lose 1 electron
25. When sodium reacts with water the products are:
- H_2 and Na_2O
 - H_2 and NaOH
 - H_2 and NaH
 - O_2 and NaOH
 - O_2 and NaH
26. Which of the following is a quantitative chemical property of magnesium?
- The boiling point of magnesium is 1107°C
 - The density of magnesium is 1.74 g/cm^3
 - Magnesium reacts with chlorine to form magnesium chloride
 - Magnesium is a silvery solid.
 - Magnesium will ignite at 648°C
27. Which of the following elements has the lowest second ionization energy?
- a. Na b. K c. Mg d. Ca e. Al

28. Zinc + hydrochloric acid produces:
- hydrogen and zinc hydroxide
 - hydrogen and zinc chloride
 - hydrogen and zinc nitrate
 - chlorine and zinc hydride
 - chlorine and zinc hydroxide
29. If the molecular mass for a compound having the ratio of carbon to hydrogen atoms, 1 to 1, is 52, what would its molecular formula be?
- CH
 - C₂H₂
 - C₄H₄
 - C₅H₅
 - C₆H₆
30. What is the molar concentration of OH⁻ ions in pure water?
- 1.0 x 10⁻¹ mol L⁻¹
 - 1.0 x 10⁻⁷ mol L⁻¹
 - 1.0 x 10⁻¹⁰ mol L⁻¹
 - 1.0 x 10⁻¹⁴ mol L⁻¹
31. Experimentally, a strong acid differs from a weak acid in :
- concentration
 - solubility
 - electrical conductivity
 - its reaction with litmus paper
32. Consider the following equation :
- $$\text{HCl} + \text{NaOH} \Rightarrow \text{NaCl} + \text{H}_2\text{O}$$
- What mass of NaOH would be required to produce 117 g of NaCl?
- 117 g
 - 58.5 g
 - 40 g
 - 80 g
 - 20 g
33. The concentration of OH⁻ ions in a solution with a pH of 3 is:
- 1.0 x 10⁻³ mol L⁻¹
 - 1.0 x 10³ mol L⁻¹
 - 1.0 x 10⁻¹ mol L⁻¹
 - 1.0 x 10⁻¹¹ mol L⁻¹
34. The pH at which the colour of an indicator changes is called the :
- endpoint
 - turning point
 - equivalence point
 - neutralization point
 - titration point
35. Which of the following 1 mol L⁻¹ solutions will be the poorest conductor of electricity ?
- hydrochloric acid
 - acetic acid
 - sodium hydroxide
 - sodium chloride
36. If 4.0 g of sodium hydroxide is dissolved in enough water to make 400 mL of solution, what is the molar concentration of sodium ions in the solution?
- 10.0 mol L⁻¹
 - 0.40 mol L⁻¹
 - 0.25 mol L⁻¹
 - 0.040 mol L⁻¹
 - 0.010 mol L⁻¹
37. AB₂ is the salt of a strong acid and a weak base. A 0.02 mol L⁻¹ solution of this salt is a saturated solution at 25 °C. What is the concentration of B⁻ ions in solution?
- 1.0 x 10⁻⁷ mol L⁻¹
 - 4.0 x 10⁻⁴ mol L⁻¹
 - 1.0 x 10⁻³ mol L⁻¹
 - 2.0 x 10⁻² mol L⁻¹
 - 4.0 x 10⁻² mol L⁻¹
38. The pH of tomato juice is 4.5. The [H⁺] in tomato juice is:
- 3.2 x 10⁻¹⁰ mol L⁻¹
 - 3.2 x 10⁻⁵ mol L⁻¹
 - 5.0 x 10⁻⁴ mol L⁻¹
 - 4.5 mol L⁻¹
 - 3.2 x 10¹⁰ mol L⁻¹

39. The boiling point of oxygen is -183°C , and its freezing point is -219°C .
Within 50 K of absolute zero, oxygen is a :

- a) gas b) liquid c) solid d) solution

40. Which one of the following statements is true?

- a) a decrease in pressure on a gas causes a decrease in volume
b) absolute zero is -273 K
c) an increase in the pressure of a gas could be due to a decrease in the number of molecules
d) in a mixture of gases, the one with the most molecules exerts the most pressure.

41. Which one of the following is a basic assumption of the kinetic molecular theory?

- a) particles are in constant random motion
b) particles lose energy with an increase in velocity
c) particles travel faster as the temperature decreases
d) particles lose energy when the temperature increases.

42. A vessel contains 2.50 mol of oxygen gas, 0.50 mol of nitrogen gas and 1.00 mol of carbon dioxide gas. The total pressure is 200 kPa. The partial pressure exerted by the oxygen gas in the mixture is:

- a) 125 kPa b) 150 kPa c) 200 kPa d) 250 kPa

43. The density of an unknown gas is 1.34 g L^{-1} at STP. The gas could be:

- a) F_2 b) Cl_2 c) CH_4 d) CH_2O

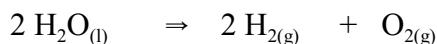
44. A gas occupies 40.0 mL at -123°C . What volume does it occupy at 27°C , assuming pressure is constant?

- a) 182 mL b) 8.80 mL c) 80.0 mL d) 20.0 mL

45. A gas occupies a volume of 0.2 L at 25 kPa. What volume will the gas occupy at 2.5 kPa assuming the temperature is kept constant.

- a) 0.02 L b) 2 L c) 20 L d) 4 L

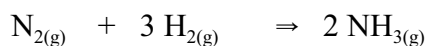
46. The following equation represents the electrolysis of water:



What volume of oxygen gas will be evolved if 360 g of water are electrolyzed at 273 K and 101.3 kPa ?

- a) 224 L b) 245 L c) 448 L d) 490 L

47. What volume of ammonia, NH_3 , will be produced when 200 L of nitrogen gas reacts with a sufficient quantity of hydrogen gas at 0°C and 100 kPa according to the following equation?



- a) 200 L b) 300 L c) 400 L d) 500 L

48. 5.02 g of an unknown gas is sealed in a 1.0 L flask at 37°C and 3.75 atm. Which one of the following is most likely to be the unknown? ($R = 0.0821\text{ atm L K}^{-1}\text{ mol}^{-1}$)

- a) H_2O b) HBr c) HCN d) H_2S

49. For a substance that remains a gas under the conditions listed, deviation from the ideal gas law would be most pronounced at :

- a) 100 °C and 2.0 atm b) 0 °C and 2.0 atm
c) - 100 °C and 2.0 atm d) - 100 °C and 4.0 atm

50. Given the following equation:



How many moles of CaCl_2 would one obtain by making 112 L of CO_2 at 0 °C and 101.3 kPa ?

- a) 0.200 mol b) 4.68 mol c) 5.00 mol d) 112 mol