Chemistry Exam Review - Grade 11

2016-2017

1. How many H-atoms are there in 0.500 mol of CH_3COOH?

2. In a glass containing 9.00 g H_2O, how many molecules of water are present? ($M_R(H_2O) = 18.00 g\ mol^{-1}$)

3. In 3.60×10^{24} molecules of $H_2SO_{4\,(aq)}$, what is the mass of the sulphuric acid? ($M_R(H_2SO_{4\,(aq)}) = 98.00\ g\ mol^{-1}$)

4. Calculate the number of oxygen atoms in each of the following samples:
a. 2.00 mol of iron (III) nitrate hexahydrate
b. 5.00 mol of ammonium sulfate

5. What is the percent composition by mass of Mg in MgO? (M_R (MgO) = 40.0 g mol^{-1})

6. For which one of the following is the empirical formula and the molecular formula the same?

A. C_5H_{12} B. C_4H_8 C. C_6H_6 D. $C_2H_6O_6$

7. Which one of the following has a molar mass of 56.0 g mol^{-1}?

A. NaCl B. $Mg(OH)_2$ C. KOH D. NaOH

8. Calculate the percentage composition of oxygen by mass in each of the following:
a. $H_2SO_{4(aq)}$
b. $AgNO_{3(s)}$

9. What is the molecular formula for a compound for which the empirical formula is CH_2O and has a molar mass of 180.0 g mol^{-1}?

10. An oxide of nitrogen was found to contain 36.8 % nitrogen by mass:
a. Determine the empirical formula for this compound
b. If the molar mass of this compound was found to be 76.02 g mol^{-1}. What is the molecular formula of this compound?

11. Methanol, $CH_3OH_{(l)}$, burns in excess oxygen to produce carbon dioxide gas and water, according to the following equation:

$$2CH_3OH_{(l)} + 3O_{2(g)} \longrightarrow 2CO_{2(g)} + 4H_2O_{(l)}$$

a. Determine the mass of oxygen required to completely burn 3.20 g of methanol.
b. How many grams of carbon dioxide are produced when 3.20 g methanol is completely burned in 3.20 g of oxygen gas?

12. Silicon tetrafluoride is produced from the reaction of silicon dioxide and hydrofluoric acid, with water as the other product.

a. Write a balanced equation for the reaction.

b. What mass of silicon tetrafluoride can be produced from 15.00 g of silicon dioxide in excess hydrofluoric acid?

c. If the actual yield of silicon tetrafluoride is 17.92 g, what is the percentage yield?

13. Assume that 13.1 g of potassium are reacted with 18.0 g of oxygen gas to produce potassium oxide.

a. Write a balanced equation for the reaction.

b. Determine which reactant is in excess

c. Calculate the number of gram of products formed.

d. What mass of the excess reactant remains unused?

14. The reaction below represents the reduction of iron ore to produce iron.

$$2Fe_2O_3 + 3C \longrightarrow 4Fe + 3CO_2$$

A mixture of 30.0 kg of Fe_2O_3 and 5.00 kg of C was heated until no further reaction occurred. Calculate the maximum mass of iron that can be obtained from these masses or reactants.

15. What volume of a 0.36 mol/L solution of $KCl_{(aq)}$ contains 0.0990 mol of the solute?

16. What mass of copper (II) sulfate pentahydrate is needed to prepare 150.0 mL of a 0.125 mol L^{-1} solution?

17. Calculate the volume of 1.50 M sodium hydroxide solution required to completely neutralize 100.0 mL of 0.750 M sulphuric acid solution.

18. Calculate the concentration of hydrogen ions in a solution with the pH of 2.15

19. A solution of calcium nitrate is mixed with sodium phosphate. A precipitate forms in the presence of a soluble solution.

a. Give the name and the formula for the possible precipitate.

b. Write a balanced equation for the reaction described, include state symbols.

c. Show a complete dissociated equation for the above reaction described.

d. Write a net ionic equation for the above reaction.

e. In an experiment 19.50 mL of 0.150 mol L^{-1} calcium nitrate solution reacted completely with 25.80 mL of 0.250 mol L^{-1} sodium phosphate solution, calculate the mass of the precipitate produced in this reaction.

20. A solution contains 0.00365 g of HCl per litre . What is the:

a. $[H^+]$ b. $[OH^-]$ c. pH d. pOH

21. Given the reaction: 3

$$HSO_4^{-1}{}_{(aq)} + H_2O_{(l)} \rightleftharpoons SO_4^{-2}{}_{(aq)} + H_3O^{+1}{}_{(aq)}$$

Identify the:

acid _____ and its conjugate base _____

base _____ and its conjugate acid _____

22. A sample of a mixture of gases contains 80.0 % nitrogen gas and 20.0 % oxygen gas by volume. Calculate the mass of 1.00 L of this mixture at STP.

23. Calculate the pressure exerted by 6.60 g of carbon dioxide gas at 25.0 ^{O}C in a 2.00 L container.

24. A 100 L helium balloon at a temperature of 22.0 ^{O}C and a pressure of 150 kPa is released and rises to an altitude of 10.0 km where the air pressure is 29.3 kPa and the temperature is –43.5 ^{O}C Assuming the surface containing the balloon does not exert any pressure itself, what would be the new volume of the balloon at this altitude?

25. Isopropyl alcohol, C_3H_7OH, makes an excellent fuel for cars.

a. Write a chemical equation representing complete combustion of isopropyl alcohol.

b. What volume of oxygen at 100.0 kPa and 23.0 ^{O}C is needed to burn 4.33 kg of isopropyl alcohol?

26. What is the molecular mass of a gas if 0.858 g of it occupy 150.0 cm^3 at 106.3 kPa and 2.00 ^{O}C?

27. An excess of hydrogen gas reacts with 14.0 g of nitrogen gas. How many mL of ammonia are produced at STP?

28. How many grams of of solid antimony (III) chloride can be produced from 3750 mL of chlorine gas at STP reacting with an excess of antimony?

29. How many mL of hydrogen gas is produced from the reaction of 28.0 g of zinc reacting with 75.0 mL of 2.50 mol L^{-1} sulphuric acid at STP?

30. Jupiter's atmosphere contains a high concentration of a gas unknown on Earth, it contains 64.8 % carbon, 13.5 % hydrogen and 21.7 % oxygen.

a. Calculate the empirical formula of this unusual gas.

b. On the surface of Jupiter, where the temperature is 208 ^{O}C and the pressure is 98.3 kPa, 54.5 cm^3 of this gas has a mass of 0.100 g. Calculate the molar mass of the gas.

c. Use the results of your calculations on parts (a) and (b) to determine the molecular formula of the gas.

Answers

1. 1.20×10^{24}
2. 3.01×10^{23}
3. 586 g
4. a. 1.80×10^{25} b. 1.20×10^{25}
5. 60.7 %
6. A
7. C
8. a. 64.0 % b. 28.2 %
9. $C_6H_{12}O_6$
10. a. N_2O_3 b. N_2O_3
11. a. 4.80 g b. 2.93 g
12. b. 2.60 g c. 68.9 %
13. b. $O_{2(g)}$ c. 15.8 g d. 15.4 g
14. 21.0 g
15. 0.275 L
16. 4.68 g
17. 0.100 L
18. 7.08×10^{-3} mol L^{-1}
19. a. $Ca_3(PO_4)_{2(s)}$ e. 0.302 g
20. a. 10^{-4} M b. 10^{-10} M c. 4 d. 10
21. acid: HSO_4^- — conjugate base: SO_4^{-2}; base: H_2O — conjugate acid: H_3O^{+1}
22. Mass: O_2 = 1.00 g, mass N_2 = 0.28 g
23. 186 kPa
24. 398 L
25. 8000 L
26. 123 g mol^{-1}
27. 2.25×10^4 mL
28. 23.9 g
29. 4.26 L
30. a. $C_4H_{10}O$ b. 74.6 g mol^{-1} c. $C_4H_{10}O$