
1. Calculate the molecular mass of table sugar sucrose ($C_{12}H_{22}O_{11}$).

A. 342.30 amu

C. 320.05 amu

B. 160.03 amu

D. 171.15 amu

2. How many oxygen atoms are in 34.5 g of $NaNO_3$?

A. 2.34×10^{23} atoms

C. 7.33×10^{23} atoms

B. 5.81×10^{26} atoms

D. 8.21×10^{22} atoms

3. Calculate the mass percent of oxygen in the amino acid, serine, which has the molecular formula $C_3H_7NO_3$.

A. 0.46%

C. 13.33%

B. 15.22%

D. 45.67%

4. Aluminum chloride is 20.2% aluminum by mass. Calculate the mass of aluminum in a 35.0 gram sample of aluminum chloride.

A. 6.49 g

C. 7.07 g

B. 20.4 g

D. 5.24 g

5. A laboratory analysis of citric acid (compound responsible for the sour taste of lemons) determined the following mass percent composition 37.51% carbon, 4.20% hydrogen and 58.29% oxygen. Find the empirical formula.

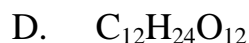
A. $C_3H_4O_3$

C. $C_6H_8O_5$

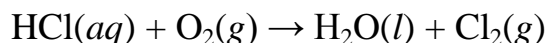
B. $C_6H_8O_7$

D. $C_5H_8O_7$

6. A compound has an empirical formula of CH_2O and the molar mass of the compound is 180g/mol . What is the molecular formula?



7. Consider the following unbalanced chemical equation. When properly balanced, what is the coefficient of HCl ?



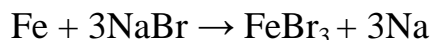
A. 1

B. 2

C. 3

D. 4

8. How many moles of NaBr are needed to react with 0.75 moles of Fe according to the following reaction?



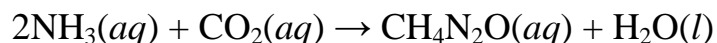
A. 0.75 moles

C. 0.25 moles

B. 1.50 moles

D. 2.25 moles

9. Urea ($\text{CH}_4\text{N}_2\text{O}$) is a common fertilizer that can be synthesized by the reaction of ammonia with carbon dioxide:



Starting with 50.0 g of NH_3 , how many grams of CO_2 are required for the NH_3 to be completely consumed?

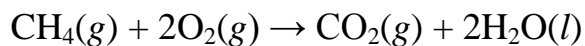
A. 64.6 g

C. 1.47 g

B. 129 g

D. 25.0 g

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10. When 25.2 grams of methane (CH_4) reacts with an excess of oxygen, according to the following reaction, 45.8 grams of water are collected. What is the percent yield?



- A. 80.9% C. 16.9 %
B. 38.2 % D. 45.4 %

-
11. How many liters of a 0.225M NaOH solution contain 0.325 mol of NaOH?

- A. 1.44 L C. 0.073 L
B. 0.692 L D. 0.550 L

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12. A solution of 0.512 M KOH is diluted from 1.32 L to 2.4 L. What is the final concentration of KOH?

- A. 0.28 M C. 0.11 M
B. 3.1 M D. 0.89 M

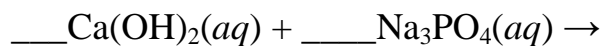
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13. Which one of the following product compounds would precipitate in an aqueous reaction?

- A. Li_2SO_4 C. $\text{Al}_2(\text{SO}_4)_3$
B. ZnSO_4 D. BaSO_4

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14. What is the net ionic equation resulting from the mixture of aqueous solutions of silver nitrate and potassium sulfide?

- A. $2\text{Ag}^+(aq) + \text{NO}_3^-(aq) + 2\text{K}^+(aq) + \text{S}^{2-}(aq) \rightarrow \text{Ag}_2\text{S}(s) + 2\text{K}^+(aq) + \text{NO}_3^-(aq)$
B. $2\text{Ag}^+(aq) + \text{S}^{2-}(aq) \rightarrow \text{Ag}_2\text{S}(s)$
C. $2\text{Ag}^+(aq) + 3\text{NO}_3^-(aq) + 2\text{K}^+(aq) + \text{S}^{2-}(aq) \rightarrow \text{Ag}_2\text{S}(s) + 2\text{KNO}_3(s)$
D. $\text{NO}_3^-(aq) + \text{K}^+(aq) \rightarrow \text{KNO}_3(aq)$
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15. Solutions of calcium hydroxide, Ca(OH)_2 , and sodium phosphate, Na_3PO_4 , are mixed. Write the balanced **complete ionic equation** for the reaction:



- A. $\text{Ca}^{2+}(aq) + 2\text{OH}^{-}(aq) + 3\text{Na}^{+}(aq) + \text{PO}_4^{3-}(aq) \rightarrow 3\text{Na}^{+}(aq) + 2\text{OH}^{-}(aq) + \text{CaPO}_4(s)$
B. $3\text{Ca}^{2+}(aq) + 2\text{OH}^{-}(aq) + 3\text{Na}^{+}(aq) + 2\text{PO}_4^{3-}(aq) \rightarrow 3\text{Na}^{+}(aq) + 2\text{OH}^{-}(aq) + \text{Ca}_3(\text{PO}_4)_2(s)$
C. $3\text{Ca}^{2+}(aq) + 6\text{OH}^{-}(aq) + 6\text{Na}^{+}(aq) + 2\text{PO}_4^{3-}(aq) \rightarrow 6\text{Na}^{+}(aq) + 6\text{OH}^{-}(aq) + \text{Ca}_3(\text{PO}_4)_2(s)$
D. $3\text{Ca}^{2+}(aq) + 2\text{PO}_4^{3-}(aq) \rightarrow \text{Ca}_3(\text{PO}_4)_2(s)$
-
16. It requires 23.56 mL of 0.105 M sodium hydroxide to neutralize 15.00 mL of a sulfuric acid (H_2SO_4) solution. Determine the concentration of the sulfuric acid (H_2SO_4) solution.

- A. 0.0825 M
B. 0.0401 M
C. 0.169 M
D. 0.311 M

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17. What is the oxidation number of sulfur in SO_4^{2-} ?

- A. +4
B. -2
C. +6
D. +5

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18. Which of the following are redox reactions?

- I. $\text{CuSO}_4 + 2\text{NaOH} \rightarrow \text{Cu(OH)}_2 + \text{Na}_2\text{SO}_4$
II. $2\text{Al} + 3\text{MgSO}_4 \rightarrow 3\text{Mg} + \text{Al}_2(\text{SO}_4)_3$
III. $2(\text{NH}_4)_3\text{PO}_4 + 3\text{Ba(NO}_3)_2 \rightarrow \text{Ba}_3(\text{PO}_4)_2 + 6\text{NH}_4\text{NO}_3$
IV. $2\text{HNO}_3 + 3\text{H}_3\text{AsO}_3 \rightarrow 2\text{NO} + 3\text{H}_3\text{AsO}_4 + \text{H}_2\text{O}$

- A. I and II
B. III and IV
C. All of them
D. II and IV
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19. Convert 32 pounds per square inch (psi) into mmHg.
(Note: 14.7 psi = 1 atm, 1 Pa = 1N/m², 1 atm = 101.325 Pa, 1mmHg = 1 torr)

- A. 8.1×10^2 mmHg
B. 1.0×10^5 mmHg
C. 1.7×10^3 mmHg
D. 2.2 mmHg

20. A balloon has an initial volume of 3.45 L. What will the volume be if the temperature is raised from 24°C to 32°C?

- A. 3.54 L
B. 4.60 L
C. 3.35 L
D. 2.58 L

21. What is the volume occupied by 20.0 g of argon gas at a pressure of 1.05 atm and a temperature of 25.0 °C?

- A. 39.1 L
B. 11.7 L
C. 466 L
D. 0.978 L

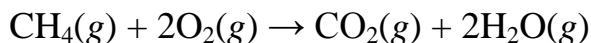
22. Determine the density in g/L of an unknown gas given that a 14.5 gram sample contains 2.00 moles at 25°C and 745 mmHg.

- A. 0.00123 g/L
B. 49.1 g/L
C. 3.49 g/L
D. 0.291 g/L

23. A 1.00 L mixture of helium, hydrogen, and xenon gas has a total pressure of 645 torr at 298 K. If the partial pressure of helium is 341 torr and the partial pressure of hydrogen is 112 torr, how many moles of xenon are present in the mixture?

- A. 0.130×10^{-2} mol
B. 1.13×10^{-1} mol
C. 1.13×10^{-3} mol
D. 1.03×10^{-2} mol
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24. The following equation shows the combustion of methane.



If 6.0 g of CH_4 reacts completely, what is the final pressure of the CO_2 produced and collected in a 1.4 L container at a temperature of 21 °C?

- A. 3.8 atm
B. 6.5 atm
C. 13 atm
D. 0.25 atm

25. Under which conditions would ammonia (NH_3) behave more like an ideal gas?

- A. High pressure and low temperature
B. High pressure and high temperature
C. Low pressure and low temperature
D. Low pressure and high temperature

26. Which one of the following statements is true?

- A. Chemical energy is associated with the motion of molecules in a gaseous sample.
B. Potential energy of molecules is based on composition.
C. An object will always have the same amounts of kinetic and potential energy.
D. The amount of energy in the universe is always decreasing.

27. Pieces of dry ice (solid CO_2) were placed inside of an empty plastic bag. The bag was then closed, and a book was placed on top of the bag. After a while, dry ice absorbed the heat inside of the bag and became CO_2 gas, and the book was raised up to 10 cm. What are the signs for work (w) and heat (q) for the system?

- A. w is positive, q is positive
B. w is positive, q is negative
C. w is negative, q is positive
D. w is negative, q is negative
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28. A system absorbs 185.5 kJ of heat as it expands to do 592 J of work (by the system) on the surroundings. What is the change in internal energy of the system?

A. 184.9 kJ

C. 186.6 kJ

B. -409.9 kJ

D. 722.9 kJ

29. In recent years, scientists have become concerned about the quantity of which one of the following gases rising in the atmosphere and trapping heat, thus causing global warming?

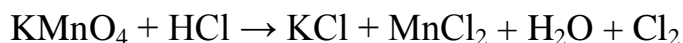
A. CO

C. NO₂

B. CO₂

D. CF₄

30. What are the correct coefficients to balance the following equation and what is the oxidation number for Mn on the left (reactant)?



A. (1,8,1,1,7,3) ; -7

C. (2,16,6,4,7,2) ; +2

B. (2,16,2,2,8,5) ; +7

D. (4,8,1,4,10,7) ; +7

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1. A
2. C
3. D
4. C
5. B
6. C
7. D
8. D
9. A
10. A
11. A
12. A
13. D
14. B
15. C
16. A
17. C
18. D
19. C
20. A
21. B
22. D
23. D
24. B
25. D
26. B
27. C
28. A
29. B
30. B