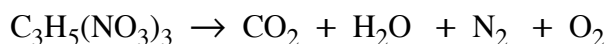


KEY

1. $\text{Co}_a\text{S}_b\text{O}_c \cdot x \text{H}_2\text{O}$ is the general formula of a certain hydrate. When 43.0 g of the compound is heated to drive off the water, 26.1 g of anhydrous compound is left ($\text{Co}_a\text{S}_b\text{O}_c$). Further analysis shows that the percentage composition of the anhydride is 42.4% Co, 23.0 % S, and 34.6% O. The empirical formula of the hydrate is

- (a) $\text{CoSO}_4 \cdot 5 \text{H}_2\text{O}$
 (b) $\text{Co}_2\text{SO}_4 \cdot 2 \text{H}_2\text{O}$
 (c) $\text{CoSO}_3 \cdot 5 \text{H}_2\text{O}$
 (d) $\text{Co}_2\text{SO}_3 \cdot 2 \text{H}_2\text{O}$
 (e) $\text{CoSO}_3 \cdot 4 \text{H}_2\text{O}$

2. The explosion of nitroglycerin is described by the unbalanced equation



How many moles of carbon dioxide are produced by the explosion of 9.25×10^{-2} moles of nitroglycerin?

- (a) $9.25 \times 10^{-2} \text{ mol}$
 (b) $2.78 \times 10^{-1} \text{ mol}$
 (c) $3.08 \times 10^{-2} \text{ mol}$
 (d) $5.55 \times 10^{-1} \text{ mol}$
 (e) None of the above

3. Which set of values is possible?

	Mass Number	Atomic Number	Number of Protons	Number of Neutrons
→ (a)	19	42	19	23
(b)	235	92	92	143
(c)	53	131	131	79
(d)	32	15	15	15
(e)	14	7	7	8

4. When solutions of AgNO_3 and Na_2CO_3 are mixed, solid Ag_2CO_3 is formed and NaNO_3 remains in solution. A solution containing 12.43 g Na_2CO_3 is mixed with a solution containing 8.37 g AgNO_3 . Which of the following statements is/are **not** true for this reaction?

- I. AgNO_3 is the limiting reactant.
 II. Na_2CO_3 is the limiting reactant.
 III. 0.0246 mol Ag_2CO_3 is produced.
 IV. This is an exchange reaction.
 V. No carbonate ion remains in solution.

- (a) II & V (b) II & IV (c) I & III (d) I, III & IV

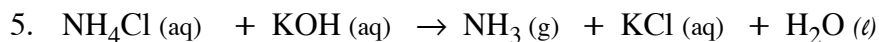
For questions 5 & 6 identify the following reactions as either:

a. acid-base

b. precipitation

c. redox

d. none of these

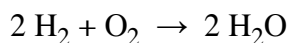


a



d

-
7. In the reaction below, 8.0 g of H_2 react with 9.0 g of O_2 . Which of the following statements is true?



- (a) The equation is not balanced.
(b) The H_2 is the limiting reactant.
(c) The O_2 is the limiting reactant.
(d) 2.0 moles of H_2O would be produced.
(e) 36 grams of H_2O would be produced.
8. The molar mass of lithium atom in a natural sample is 6.941 g/mol. The sample is known to consist of ^6Li (molar mass 6.015 g/mol) and ^7Li (molar mass 7.016 g/mol). What is true about the relative amounts of ^6Li and ^7Li in the natural sample?
- (a) Roughly equal (a bit more ^6Li)
(b) Exactly equal
(c) The majority of the sample is ^6Li
(d) The majority of the sample is ^7Li
(e) Roughly equal (a bit more ^7Li)

9. Identify the isotope that has atoms with 39 neutrons, 31 protons, and 31 electrons.

(a) ^{70}Ga

(b) ^{31}Ga

(c) ^{70}Y

(d) ^{89}Y

(e) None of the above

10. When NaCl and KNO_3 are mixed together _____ occurs.

(a) no reaction

(b) a combination reaction

(c) a displacement reaction

(d) an exchange reaction

(e) a decomposition reaction

11. Suppose you have a solution that might contain any or all of the following cations: Ni^{2+} , Ag^+ , Sr^{2+} and Ca^{2+} . Addition of KCl solution causes a precipitate to form. After filtering off the precipitate, Na_2SO_4 solution is added to the resulting solution and another precipitate forms. This is filtered off and a solution of NaOH is added to the resulting solution. No precipitate is observed. Which of the 4 ions listed above *must* be absent from the original solution?

☒ (a) Ni^{2+}

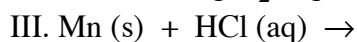
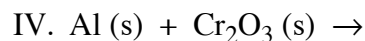
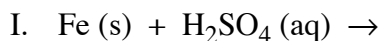
(b) Ag^+

(c) Sr^{2+}

(d) Ca^{2+}

(e) None of them

12. Based on the activity series, which of the following reactions will occur?



(a) I, III & V

(b) I & III

(c) II & V

☒ (d) I, III & IV

(e) all will occur

13. What is the oxidation number of Cr in $\text{K}_2\text{Cr}_2\text{O}_7$?

(a) +2

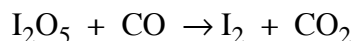
(b) +3

(c) +4

(d) +5

☒ (e) +6

14. In the following reaction, _____ is oxidized and _____ is reduced.



(a) I, C

(b) O, I

(c) I, O

(d) C, O

☒ (e) C, I

For the remaining questions determine the best answer from the following list.

K PbCl_2

L HCl

M HNO_3

N NaOH

O CaSO_4

P NaNO_2

Q $\text{Sr}_3(\text{PO}_4)_2$

R KNO_3

T CaClO

U HF

V $\text{Mg}(\text{OH})_2$

W AgCl

X NaNO_3

Y salt + water

Z salt + water + hydrogen gas

15. _____ is/are ionic compounds that cannot exist.

(a) O & P

(b) Q

(c) O

(d) T

(e) O & T

16. These compounds will not dissolve in water in large amounts.

(a) V & X

(b) K & X

(c) L

(d) K, Q, V & W

(e) Q, V & X

17. The products of the reaction between an acid and a metal carbonate.

(a) Y

(b) Z

(c) None of these

18. Strong acid(s).

(a) L, M & U

(b) L & M

(c) L & U

(d) M & U

(e) U

19. Strong base(s).

(a) N

(b) N & V

(c) V

(d) None of these

20. A product of the reaction between sodium hydroxide and dinitrogen pentoxide.

(a) M

(b) N

(c) P

(d) X