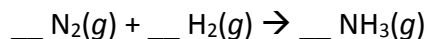


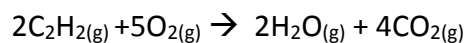
1. Ammonia can be made by the following reaction:



When the equation is properly balanced, the sum of the coefficients is

A: 6

2. Welders commonly use an apparatus that contains a tank of acetylene ( $\text{C}_2\text{H}_2$ ) gas and a tank of oxygen gas. When burned in pure oxygen, acetylene generates a large amount of heat according to the reaction below:



What volume of carbon dioxide gas at STP is produced if 1.00 g of acetylene is combusted completely?

A: 1.72 L

3. Calculate the molarity of 3.51 g of NaCl in 25 mL of water.

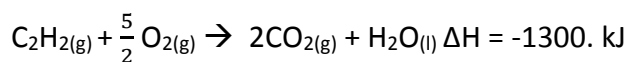
A: 2.40 M



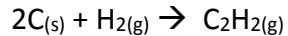
6. The specific heat of graphite (molar mass = 12.01 g/mol) is 0.71 J/g °C. Calculate the energy required to raise the temperature of 2.4 moles of graphite by 25.0 °C.

A: 511 J

7. Given the following data:



Calculate  $\Delta\text{H}$  for the following reaction:



A: 226 kJ

8. Draw the electron configuration for the following ions

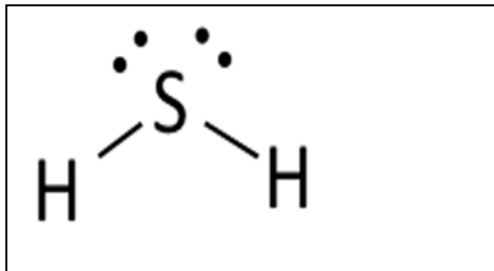
$\text{Cl}^-$ : \_\_\_\_\_  $1s^2 2s^2 2p^6 3s^2 3p^6$

$\text{Fe}^{2+}$ : \_\_\_\_\_  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^4$  or  
 $1s^2 2s^2 2p^6 3s^2 3p^6 3d^6$

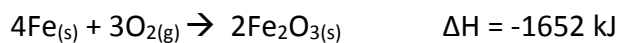
9. Draw a Lewis structure (with the proper VSEPR arrangement) for the following compound **and** name the shape of each molecule

H<sub>2</sub>S

Shape is bent



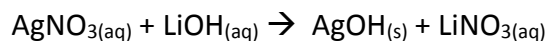
10. The reaction that occurs in heat packs used to treat sports injuries is



How much heat is released when 1.00 g of Fe<sub>(s)</sub> is reacted with excess O<sub>2(g)</sub>?

A: -7.39 kJ

11. How many grams of AgOH (molar mass = 169.9 g/mol) would be produced from 21.25 grams of AgNO<sub>3</sub> (molar mass = 124.9 g/mol) according to the reaction below:



A: 15.6 g

What would the percent yield be if 14.8 g of AgOH were made?

A: 94.9%

### Chemistry Placement Exam – Sample Test

1. The product of  $0.1400 \cdot 6.02 \cdot 10^{23}$  will have how many significant figures?

a.	2
b.	3
c.	23
d.	$10^{23}$
e.	7

ANSWER: B

2. How many significant figures should there be in the answer when you divide 4.1 by 7.464?

a.	7
b.	4
c.	3
d.	2
e.	1

ANS: D

3. How many significant figures are there in the result of the following calculation?

$$(4.321/2.8) \cdot (6.9234 \cdot 10^5)$$

a.	1
b.	2
c.	3
d.	4
e.	5

ANS: B

4. The result of the following calculation has how many significant figures?

$$(1.433) (33.1^\circ\text{C} - 31.1^\circ\text{C})(612)$$

a.	1
b.	2
c.	3
d.	4
e.	5

ANS: B

5. A student finds that the weight of an empty beaker is 14.049 g. She places a solid in the beaker to give a combined mass of 14.142 g. To how many significant figures is the mass of the solid known?

a.	2
b.	3
c.	1
d.	5
e.	4

ANS: A

6. Calculate the mass of a rectangular solid that has a density of  $3.96 \text{ g/cm}^3$  and measures 2.50 cm by 1.80 cm by 3.00 cm.

a.	3.41 g
b.	53.5 g
c.	9.90 g
d.	28.9 g
e.	56.5 g

ANS: B

7. Find the volume of an object that has a density of  $3.14 \text{ g/mL}$  and a mass of 94.7 g.

a.	30.2 mL
b.	mL
c.	297 mL
d.	mL
e.	mL

ANS: A

8. If a 100.-g sample of platinum metal has a volume of 4.671 mL, what is the density of platinum in  $\text{g/cm}^3$ ?

a.	$21.4 \text{ g/cm}^3$
b.	$2.14 \text{ g/cm}^3$
c.	$0.0467 \text{ g/cm}^3$
d.	$467 \text{ g/cm}^3$
e.	none of these

ANS: A

9. An experiment requires 74.2 mL of ethyl alcohol. If the density of ethyl alcohol is  $0.790 \text{ g/cm}^3$ , what is the mass of 74.2 mL of ethyl alcohol?

a.	93.9 g
b.	10.6 g
c.	58.6 g
d.	g
e.	none of these

ANS: C

10. If a 100.-g sample of a metal has a volume of 8.65 mL, what is the density of the metal?

a.	11.6 g/mL
b.	1.16 g/mL
c.	0.0865 g/mL
d.	9 g/mL
e.	none of these

ANS: A

11. The volume (in milliliters) occupied by 41.9 g of mercury (density =  $13.6 \text{ g/mL}$ ) is

a.	570 mL
b.	3.08 mL
c.	0.325 mL
d.	28.3 mL
e.	none of these

ANS: B

12. How many protons, electrons, and neutrons, respectively, does  $^{31}\text{P}$  have?

a.	15, 15, 16
b.	15, 16, 15
c.	16, 15, 31
d.	15, 15, 31
e.	15, 31, 16

ANS: A

13. How many protons, electrons, and neutrons, respectively, does oxygen have?

a.	8, 18, 8
b.	8, 8, 8
c.	8, 10, 8
d.	8, 14, 8
e.	8, 18, 16

ANS: B

14. The atom with 69 neutrons and 50 protons has a mass number of

a.	69
b.	50
c.	19
d.	119
e.	cannot be determined from information given

ANS: D

15. How many neutrons are contained in an iodine nucleus with a mass number of 131?

a.	53
b.	74
c.	78
d.	127
e.	131

ANS: C

16. The binary compound  $\text{PCl}_3$  is called

a.	phosphorus chloride
b.	triphosphorus chloride
c.	monophosphorus trichloride
d.	phosphorus trichloride
e.	none of these

ANS: D

17. The correct formula for ammonium sulfate is

a.	$\text{NH}_4\text{SO}_3$
b.	$\text{NH}_4\text{SO}_4$
c.	$(\text{NH}_4)_2\text{SO}_3$
d.	$(\text{NH}_4)_2\text{SO}_4$
e.	$(\text{NH}_3)_2\text{SO}_3$

ANS: D

18. The name of the  $\text{BrO}_3^-$  ion is

a.	bromate ion
b.	bromite ion
c.	hypobromite ion
d.	perbromate ion
e.	bromoxide ion

ANS: A



19. The name for  $\text{MnBr}_2$  is

a.	manganese(II) bromide
b.	manganese(I) bromide
c.	magnesium bromide
d.	manganese bromide
e.	manganese(III) bromide

ANS: A

20. The name for  $\text{Al}(\text{OH})_3$  is

a.	aluminum(III) hydroxide
b.	aluminum trihydroxide
c.	aluminum hydroxide
d.	monaluminum trihydroxide
e.	aluminum(I) hydroxide

ANS: C

21. The name for  $\text{Ba}(\text{NO}_3)_2$  is

a.	barium dinitrate
b.	barium(II) nitrate
c.	barium nitrite
d.	barium(I) nitrate
e.	barium nitrate

ANS: E

22. The name for  $\text{PCl}_5$  is \_\_\_\_\_.

ANS: phosphorus pentachloride

23. The name for  $\text{N}_2\text{O}$  is \_\_\_\_\_.

ANS: dinitrogen monoxide

24. When the following equation is balanced using the smallest possible integers, what is the number in front of the substance in bold type?



a.	1
b.	2
c.	3
d.	4
e.	5

ANS: A

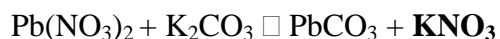
25. When the following equation is balanced using the smallest possible integers, what is the number in front of the substance in bold type?



a.	1
b.	2
c.	3
d.	4
e.	6

ANS: B

26. When the following equation is balanced using the smallest possible integers, what is the number in front of the substance in bold type?



a.	5
b.	4
c.	3
d.	2
e.	1

ANS: D

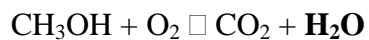
27. When the following equation is balanced using the smallest possible integers, what is the number in front of the substance in bold type?



a.	1
b.	3
c.	6
d.	9
e.	12

ANS: D

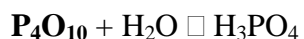
28. When the following equation is balanced using the smallest possible integers, what is the number in front of the substance in bold type?



a.	1
b.	2
c.	3
d.	4
e.	6

ANS: D

29. When the following equation is balanced using the smallest possible integers, what is the number in front of the substance in bold type?



a.	10
b.	6
c.	4
d.	2
e.	1

ANS: E

30. When the following equation is balanced using the smallest possible integers, what is the number in front of the substance in bold type?



a.	1
b.	2
c.	3
d.	4
e.	5

ANS: C

31. When the following equation is balanced using the smallest possible integers, what is the number in front of the substance in bold type?



a.	5
b.	4
c.	3
d.	2
e.	1

ANS: B

32. When the following equation is balanced using the smallest possible integers, what is the number in front of the substance in bold type?



a.	1
b.	2
c.	3
d.	4
e.	5

ANS: E

33. How many atoms of calcium are present in 58.2 g of calcium?

a.	$8.74 \cdot 10^{23}$
b.	$2.41 \cdot 10^{-24}$
c.	$3.50 \cdot 10^{25}$
d.	$6.02 \cdot 10^{23}$
e.	none of these

ANS: A

34. A 30.5-g sample of Ca contains how many calcium atoms?

a.	$4.58 \cdot 10^{23}$ atoms
b.	61.0 atoms
c.	$7.61 \cdot 10^{-1}$ atoms
d.	$1.84 \cdot 10^{25}$ atoms
e.	30.5 atoms

ANS: A

35. Calculate the mass of  $3.53 \cdot 10^{26}$  atoms of silver.

a.	$6.32 \cdot 10^4$ g
b.	$3.81 \cdot 10^{28}$ g
c.	$1.97 \cdot 10^{48}$ g
d.	$5.86 \cdot 10^2$ g
e.	none of these

ANS: A

36. 66.4 g of Pt represents how many atoms?

a.	$2.05 \cdot 10^{23}$ atoms
b.	0.340 atoms
c.	$4.00 \cdot 10^{25}$ atoms
d.	$2.15 \cdot 10^{-20}$ atoms
e.	none of these

ANS: A

37. A sample containing 0.398 mol of sodium has a mass of \_\_\_\_\_ g.

a.	9.15
b.	$1.73 \cdot 10^{-2}$
c.	23.388
d.	$5.78 \cdot 10^1$
e.	$2.40 \cdot 10^{23}$

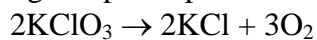
ANS: A

38. A 3.37-mol sample of aluminum represents how many atoms?

a.	$2.03 \cdot 10^{24}$ atoms
b.	$5.60 \cdot 10^{-24}$ atoms
c.	$1.25 \cdot 10^{23}$ atoms
d.	$5.48 \cdot 10^{25}$ atoms
e.	none of these

ANS: A

39. A 7.11-g sample of potassium chlorate was decomposed according to the following equation:

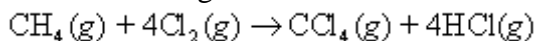


How many moles of oxygen are formed?

- A) 2.78 g
- B) 0.0580 mol
- C) 0.0387 mol
- D) 0.0870 mol
- E) none of these

ANS: D

40. Consider the following reaction:

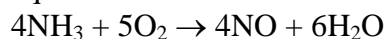


What mass of  $\text{CCl}_4$  is formed by the reaction of 5.14 g of methane with an excess of chlorine?

- A) 12.3 g
- B) 0.54 g
- C) 791 g
- D) 49.3 g
- E) none of these

ANS: D

41. Nitric oxide, NO, is made from the oxidation of  $\text{NH}_3$ , and the reaction is represented by the equation:

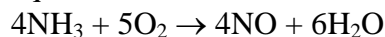


What mass of NO can be produced from 7.55 g of  $\text{NH}_3$ ?

- A) 4.28 g NO
- B) 13.3 g NO
- C) 7.55 g NO
- D) 20.0 g NO
- E) 16.6 g NO

ANS: B

42. Nitric oxide, NO, is made from the oxidation of  $\text{NH}_3$ , and the reaction is represented by the equation:



What mass of  $\text{O}_2$  would be required to react completely with 6.85 g of  $\text{NH}_3$ ?

- A) 4.56 g  $\text{O}_2$
- B) 10.3 g  $\text{O}_2$
- C) 8.04 g  $\text{O}_2$
- D) 16.1 g  $\text{O}_2$
- E) 12.9 g  $\text{O}_2$

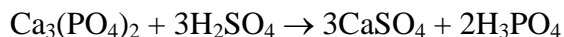
ANS: D

43. For the reaction  $\text{P}_4\text{O}_{10}(s) + 6\text{H}_2\text{O}(l) \rightarrow 4\text{H}_3\text{PO}_4(aq)$ , what mass of  $\text{P}_4\text{O}_{10}$  must be consumed if  $3.71 \times 10^{23}$  molecules of  $\text{H}_2\text{O}$  are also consumed?

- A)  $1.05 \times 10^3$  g  $\text{P}_4\text{O}_{10}$
- B) 29.1 g  $\text{P}_4\text{O}_{10}$
- C) 175 g  $\text{P}_4\text{O}_{10}$
- D) 1.85 g  $\text{P}_4\text{O}_{10}$
- E) 66.6 g  $\text{P}_4\text{O}_{10}$

ANS: B

44. Phosphoric acid can be prepared by reaction of sulfuric acid with “phosphate rock” according to the equation:



Suppose the reaction is carried out starting with 129 g of  $\text{Ca}_3(\text{PO}_4)_2$  and 97.4 g of  $\text{H}_2\text{SO}_4$ . Which substance is the limiting reactant?

- A)  $\text{Ca}_3(\text{PO}_4)_2$
- B)  $\text{H}_2\text{SO}_4$
- C)  $\text{CaSO}_4$
- D)  $\text{H}_3\text{PO}_4$
- E) none of these

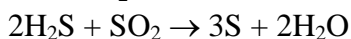
ANS: B

45. Suppose the reaction  $\text{Ca}_3(\text{PO}_4)_2 + 3\text{H}_2\text{SO}_4 \rightarrow 3\text{CaSO}_4 + 2\text{H}_3\text{PO}_4$  is carried out starting with 153 g of  $\text{Ca}_3(\text{PO}_4)_2$  and 76.8 g of  $\text{H}_2\text{SO}_4$ . How much phosphoric acid will be produced?

- A) 76.7 g
- B) 51.1 g
- C) 229.8 g
- D) 115.1 g
- E) 96.7 g

ANS: B

46.  $\text{SO}_2$  reacts with  $\text{H}_2\text{S}$  as follows:

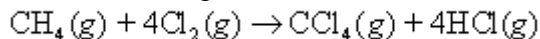


When 7.50 g of  $\text{H}_2\text{S}$  reacts with 12.75 g of  $\text{SO}_2$ , which statement applies?

- A) 6.38 g of sulfur are formed.
- B) 10.6 g of sulfur are formed.
- C) 0.0216 moles of  $\text{H}_2\text{S}$  remain.
- D) 1.13 g of  $\text{H}_2\text{S}$  remain.
- E)  $\text{SO}_2$  is the limiting reagent.

ANS: B

47. Consider the following reaction:



What mass of  $\text{CCl}_4$  will be formed if 1.20 moles of methane react with 1.11 moles of chlorine?

- A) 185 g
- B) 171 g
- C) 683 g
- D) 42.7 g
- E) 19.7 g

ANS: D

48. The electron configuration for the barium atom is:

- A)  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10}$
- B)  $[\text{Xe}]6s^2$
- C)  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$
- D)  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$
- E) none of these

ANS: B

49. The electron configuration for the carbon atom is:

- A)  $1s^2 2s^2 2p^2$
- B)  $[\text{He}]2s^4$
- C)  $[\text{Ne}]2s^2 2p^2$
- D)  $1s^2 2p^4$
- E) none of these

ANS: A

50. All alkaline earths have the following number of valence electrons:

- A) 1
- B) 3
- C) 6
- D) 2
- E) none of these

ANS: D

51. Order the elements S, Cl, and F in terms of increasing ionization energy.

- A) S, Cl, F
- B) Cl, F, S
- C) F, S, Cl
- D) F, Cl, S
- E) S, F, Cl

ANS: A

52. Order the elements S, Cl, and F in terms of increasing atomic radii.

- A) S, Cl, F
- B) Cl, F, S
- C) F, S, Cl
- D) F, Cl, S
- E) S, F, Cl

ANS: D



53.  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^2$  is the correct electron configuration for which of the following atoms?
- A) Ca
  - B) Ti
  - C) Ge
  - D) Zr
  - E) none of these

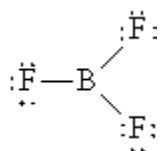
ANS: B

54. Which of the following compounds contains only one unshared pair of valence electrons?
- A)  $\text{NH}_3$
  - B)  $\text{H}_2\text{O}$
  - C)  $\text{CH}_4$
  - D)  $\text{NaCl}$
  - E)  $\text{BF}_3$

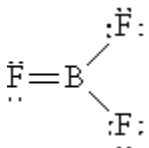
ANS: A

55. Which of the following Lewis structures best describes  $\text{BF}_3$ ?

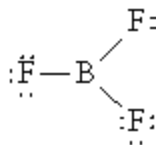
A)



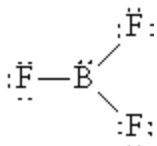
B)



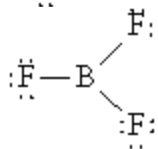
C)



D)



E)



ANS: A

56. The molecular structure of  $\text{OF}_2$  is
- A) pyramidal
  - B) none of these
  - C) octahedral
  - D) trigonal planar
  - E) V-shaped

ANS: E

57.  $\text{NI}_3$
- A) pyramidal
  - B) tetrahedral
  - C) square planar
  - D) octahedral
  - E) none of these

ANS: A

58.  $\text{SiH}_4$
- A) pyramidal
  - B) tetrahedral
  - C) square planar
  - D) octahedral
  - E) none of these

ANS: B

59. The molecular structure of  $\text{NCl}_3$  is
- A) pyramidal
  - B) none of these
  - C) octahedral
  - D) trigonal planar
  - E) bent

ANS: A

60. A 16.4-g sample of HF is dissolved in water to give  $2.0 \times 10^2$  mL of solution. The concentration of the solution is:
- A) 0.82 M
  - B) 0.16 M
  - C) 0.08 M
  - D) 4.1 M
  - E) 8.2 M

ANS: D

61. A 38.1-g sample of  $\text{SrCl}_2$  is dissolved in 112.5 mL of solution. Calculate the molarity of this solution.
- A) 27.0 *M*
  - B) 2.14 *M*
  - C) 53.7 *M*
  - D) 0.339 *M*
  - E) none of these

ANS: B

62. You mix 55 mL of 1.00 *M* silver nitrate with 25 mL of 0.84 *M* sodium chloride. What mass of silver chloride should you form?
- A) 3.0 g
  - B) 6.0 g
  - C) 3.3 g
  - D) 6.6
  - E) none of these

ANS: A

63. Calculate the  $[\text{H}^+]$  in a solution that has a pH of 9.88.
- A) 4.1 *M*
  - B) 9.9 *M*
  - C)  $7.6 \times 10^{-5}$  *M*
  - D)  $1.3 \times 10^{-10}$  *M*
  - E) none of these

ANS: D

64. Calculate the  $[\text{H}^+]$  in a solution that has a pH of 2.73.
- A) 2.7 *M*
  - B) 11.3 *M*
  - C)  $1.9 \times 10^{-3}$  *M*
  - D)  $5.4 \times 10^{-12}$  *M*
  - E) none of these

ANS: C

65. Calculate the  $[\text{H}^+]$  in a solution that has a pH of 8.73.
- A)  $1.9 \times 10^{-9}$  *M*
  - B)  $5.4 \times 10^{-6}$  *M*
  - C)  $8.7 \times 10^{-9}$  *M*
  - D)  $9.4 \times 10^{-1}$  *M*
  - E)  $7.2 \times 10^{-1}$  *M*

ANS: A

66. The pH of a solution at 25°C in which  $[\text{OH}^-] = 3.9 \times 10^{-5} \text{ M}$  is:
- A) 4.41
  - B) 3.90
  - C) 9.59
  - D) 4.80
  - E) none of these

ANS: C

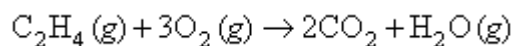
67. You fill a balloon with 2.50 moles of gas at 22°C at a pressure of 1.62 atm. What is the volume of the balloon?
- A) 15.7 L
  - B) 98.0 L
  - C) 37.4 L
  - D) 2.79 L
  - E) 22.4 L

ANS: C

68. What volume is occupied by 21.0 g of methane ( $\text{CH}_4$ ) at 27°C and 1.25 atm?
- A) 37.2 L
  - B) 25.8 L
  - C) 2.32 L
  - D)  $4.14 \times 10^2$  L
  - E) not enough data to calculate

ANS: B

69. Gaseous  $\text{C}_2\text{H}_4$  reacts with  $\text{O}_2$  according to the following equation:

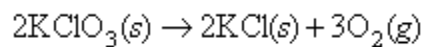


What volume of oxygen gas at STP is needed to react with 5.75 mol of  $\text{C}_2\text{H}_4$ ?

- A) 17.3 L
- B) 42.9 L
- C)  $3.86 \times 10^2$  L
- D)  $1.29 \times 10^2$  L
- E) Not enough information is given to solve the problem.

ANS: C

70. Given the equation:



A 3.00-g sample of  $\text{KClO}_3$  is decomposed and the oxygen at  $24.0^\circ\text{C}$  and  $0.717\text{ atm}$  is collected. What volume of oxygen gas will be collected assuming 100% yield?

- A)  $8.32 \times 10^2\text{ mL}$
- B)  $1.01 \times 10^2\text{ mL}$
- C)  $1.25 \times 10^3\text{ mL}$
- D)  $5.55 \times 10^2\text{ mL}$
- E) none of these

ANS: C