

CHM 1045 Qualifying Exam

1. Which of the following is the basic unit of volume in the metric system?
 - A) liter
 - B) kilogram
 - C) meter
 - D) centimeter
 - E) gram
2. Which of the following is the largest unit?
 - A) millimeter
 - B) micrometer
 - C) meter
 - D) decimeter
 - E) kilometer
3. How many pounds (lbs) are in 3.5 kg? $1 \text{ kg} = 2.20 \text{ lb}$
 - A) 7.7 lb
 - B) 1.59 lb
 - C) 0.63 lb
 - D) 1.6 lb
 - E) 5.7 lb
4. What is 6.50 meters converted to inches? $2.54 \text{ cm} = 1 \text{ inch}$
 - A) 0.0256 in
 - B) 1651 in
 - C) 39.1 in
 - D) 256 in
 - E) 0.165 in
5. If the temperature is $20.^\circ\text{C}$, what is the corresponding temperature on the Fahrenheit scale?
 $^\circ\text{F} = 1.8^\circ\text{C} + 32$
 - A) -22°F
 - B) 68°F
 - C) 43°F
 - D) 239°F
 - E) 94°F
6. A serving of fish contains 50 g protein and 4 g of fat. If protein has a caloric value of 4 kcal/g and fat has 9 kcal/g, how many kcal are in the serving? (round the answer to 2 significant figures).
 - A) 240 kcal
 - B) 54 kcal
 - C) 470 kcal
 - D) 220 kcal
 - E) 490 kcal

7. A nugget of gold with a mass of 521 g is added to 50.0 mL of water. The water level rises to a volume of 77.0 mL. What is the density of the gold?
- A) 10.4 g/mL
 B) 6.77 g/mL
 C) 1.00 g/mL
 D) 0.0518 g/mL
 E) 19.3 g/mL
8. Mercury has a density of 13.6 g/mL. How many milliliters of mercury have a mass of 350. g?
- A) 0.0389 mL
 B) 364 mL
 C) 25.7 mL
 D) 336 mL
 E) 4760 mL
9. The measurement 0.0000043 m, expressed correctly using scientific notation, is
- A) 4.3×10^{-7} m
 B) 4.3×10^{-6} m
 C) 4.3×10^6 m
 D) 0.43×10^{-5} m
 E) 4.3 m
10. What is the correct answer for the calculation of a volume with measured numbers

$$\frac{28.58}{16 \times 8.02}$$

- A) 0.22 mL
 B) 4.5 mL
 C) 57 mL
 D) 14 mL
 E) 1.2 mL

11. Evaluate

$$\frac{1.1 \times 10^{-1}}{5.5 \times 10^{-5}}$$

- A) 0.20×10^{-6}
 B) 0.20×10^{-4}
 C) 2.0×10^3
 D) 2.0×10^4
 E) -4.4×10^4

12. Select all the chemical changes from below:

i. Boiling water

ii. Breaking a bone

iii. Photosynthesis

iv. Burning paper

v. Metal rusting

vi. Baking bread

A) ii, iii, iv, v, vi

B) i, ii, vi

C) iii, iv, v, vi

D) iv, v

E) all of the above

13. The physical state(s) present when a substance is condensing is (are)

A) solid.

B) liquid.

C) gas.

D) solid + liquid.

E) liquid + gas.

14. Identify the charges of the protons, neutrons, and electrons.

A) protons +1, neutrons 0, electrons -1

B) protons 0, neutrons -1, electrons +1

C) protons -1, neutrons 0, electrons +1

D) protons 0, neutrons +1, electrons -1

E) protons +1, neutrons -1, electrons 0

15. Which of the following statements about subatomic particles is TRUE?

A) A neutral atom contains the same number of protons and electrons.

B) Protons have about the same mass as electrons.

C) Electrons make up most of the mass of an atom.

D) Protons and neutrons have opposite, but equal in magnitude, charges.

E) Neutrons and electrons are found in the nucleus of an atom.

16. The chemical symbol for the element iron is

A) Ir

B) I

C) Fe

D) In

E) Fr

17. What is the symbol of the element in Group 4A(14) and Period 2?

A) Be

B) Mg

C) Ca

D) C

E) Si

18. What is the symbol for an atom of the element that has 5 protons and 6 neutrons?

- A) B
- B) C
- C) H
- D) Na
- E) Pb

19. Determine the number of protons, neutrons and electrons in the following:



- A) $p^+ = 18$, $n^\circ = 18$, $e^- = 22$
- B) $p^+ = 18$, $n^\circ = 22$, $e^- = 18$
- C) $p^+ = 22$, $n^\circ = 18$, $e^- = 18$
- D) $p^+ = 18$, $n^\circ = 22$, $e^- = 40$
- E) $p^+ = 40$, $n^\circ = 22$, $e^- = 18$

20. What species is represented by the following information?

$$p^+ = 12 \qquad n^\circ = 14 \qquad e^- = 10$$

- A) Si^{4+}
- B) Mg
- C) Ne
- D) Si
- E) Mg^{2+}

21. Which of the following pairs of elements consists of metals only?

- A) Al and Cl
- B) N and Se
- C) V and Ar
- D) Cu and Pb
- E) Mg and H

22. The element fluorine (F) has how many valence electrons?

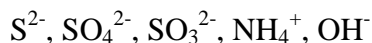
- A) 0
- B) 2
- C) 7
- D) 9
- E) 19

23. In ionic compounds, metals _____ their valence electrons to form _____ charged ions.

- A) lose, negatively
- B) lose, positively
- C) gain, negatively
- D) gain, positively
- E) share, negatively

24. Predict the charge that an aluminum (Al) ion would have.
- A) 5-
 - B) 1+
 - C) 1-
 - D) 2+
 - E) 3+
25. Predict the charge that an ion formed from sulfur (S) would have.
- A) 1-
 - B) 6+
 - C) 3-
 - D) 4+
 - E) 2-
26. The correct formula for a compound formed from the elements Al and O is
- A) AlO
 - B) Al₂O
 - C) Al₃O₂
 - D) AlO₃
 - E) Al₂O₃
27. Which one of the following compounds contains an ion with a 3+ charge?
- A) KCl
 - B) Na₂O
 - C) FeCl₃
 - D) CuCl
 - E) MgCl₂
28. The compound MgCl₂ is named
- A) magnesium chlorine.
 - B) magnesium dichloride.
 - C) magnesium (II) chloride.
 - D) magnesium chloride.
 - E) dimagnesium chloride.
29. The roman numeral III in the name titanium (III) oxide indicates that:
- A) There are three oxygen atoms per formula unit of the compound
 - B) There are three titanium atoms per formula unit of the compound
 - C) There are three times as many titanium atoms present as there are oxygen atoms
 - D) Titanium is present in the form of a 3+ ion

30. The correct name for the ions below (in the order written) is:



- A) sulfite, sulfate, sulfide, ammonium, hydroxide
- B) sulfite, sulfate, sulfide, hydroxide, ammonium
- C) sulfide, sulfate, sulfite, ammonium, hydroxide
- D) sulfide, sulfate, sulfite, hydroxide, ammonium
- E) sulfide, sulfite, sulfate, ammonium, hydroxide

31. What is the formula for aluminum nitrate?

- A) Al_2NO_2
- B) $AlNO_3$
- C) $Al(NO_2)_3$
- D) $Al(NO_3)_3$
- E) $Al_2(NO_2)_2$

32. What is the formula of a compound that contains Na^+ and PO_4^{3-} ions?

- A) Na_3PO_4
- B) $NaPO_4$
- C) Na_2PO_3
- D) Na_3PO_3
- E) Na_3P

33. The correct name for the compound N_2O_3 is

- A) nitrogen oxide.
- B) nitrogen trioxide.
- C) dinitride trioxide.
- D) dinitrogen oxide.
- E) dinitrogen trioxide.

34. In a molecule with covalent bonding,

- A) oppositely charged ions are held together by strong electrical attractions.
- B) atoms of metals form bonds to atoms of nonmetals.
- C) atoms of different metals form bonds.
- D) atoms are held together by sharing electrons.
- E) atoms of noble gases are held together by attractions between oppositely charged ions.

35. The molecule HCN has the following Lewis structure:

- A) $H-C-N:$
- B) $H-C=N:$
- C) $H-C\equiv N:$
- D) $H=C=N:$
- E) $H\equiv C-N:$

36. The number of oxygen atoms in one formula unit of $\text{Mg}_3(\text{PO}_4)_2$ is:

- A) 2
- B) 3
- C) 4
- D) 6
- E) 8

37. What is the molar mass (mass of a mol) of glucose ($\text{C}_6\text{H}_{12}\text{O}_6$)?

- A) 24 g/mol
- B) 96 g/mol
- C) 136 g/mol
- D) 180 g/mol
- E) 224 g/mol

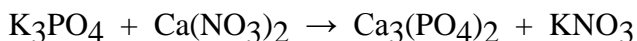
38. How many moles of potassium (K) are contained in 449 g of potassium?

- A) 11.5 moles
- B) 17.6 moles
- C) 69.2 moles
- D) 23.9 moles
- E) 41.5 moles

39. Calculate the number of molecules in 4.53 moles of water.

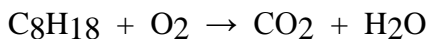
- A) 2.73×10^{24}
- B) 6.02×10^{23}
- C) 4.01×10^{25}
- D) 1.01×10^{22}
- E) 0.75×10^{-23}

40. Which of the following gives the balanced equation for this reaction?



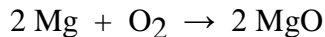
- A) $\text{KPO}_4 + \text{CaNO}_3 + \text{KNO}_3$
- B) $\text{K}_3\text{PO}_4 + \text{Ca}(\text{NO}_3)_2 \rightarrow \text{Ca}_3(\text{PO}_4)_2 + 3\text{KNO}_3$
- C) $2\text{K}_3\text{PO}_4 + \text{Ca}(\text{NO}_3)_2 \rightarrow \text{Ca}_3(\text{PO}_4)_2 + 6\text{KNO}_3$
- D) $2\text{K}_3\text{PO}_4 + 3\text{Ca}(\text{NO}_3)_2 \rightarrow \text{Ca}_3(\text{PO}_4)_2 + 6\text{KNO}_3$
- E) $\text{K}_3\text{PO}_4 + \text{Ca}(\text{NO}_3)_2 \rightarrow \text{Ca}_3(\text{PO}_4)_2 + \text{KNO}_3$

41. When the following equation is balanced, the coefficients are _____.



- A) 2, 3, 4, 4
- B) 1, 4, 8, 9
- C) 2, 12, 8, 9
- D) 4, 4, 32, 36
- E) 2, 25, 16, 18

For the questions 42-43 consider the following balanced equation.



42. The number of moles of oxygen gas needed to react with 4.0 moles of Mg is
- A) 1.0 mole.
 - B) 2.0 moles.
 - C) 3.0 moles.
 - D) 4.0 moles.
 - E) 6.0 moles.
43. The number of moles of MgO produced when 0.20 mole of O₂ reacts completely is
- A) 0.10 mole.
 - B) 0.20 mole.
 - C) 0.40 mole.
 - D) 0.60 mole.
 - E) 0.80 mole.
44. A gas contained in a steel tank has a pressure of 1.5 atm at a temperature of 320 K. What will be the gas pressure when the temperature changes to 450 K?
- A) 1.5 atm
 - B) 0.94 atm
 - C) 0.47 atm
 - D) 2.1 atm
45. The volume of a gas with a pressure of 1.2 atm increases from 1.0 L to 4.0 L. What is the final pressure of the gas, assuming constant temperature?
- A) 1.2 atm
 - B) 0.30 atm
 - C) 3.3 atm
 - D) 4.8 atm
 - E) 1.0 atm
46. The ideal gas law may be written as $PV = nRT$, where $n = \frac{m}{M}$. Express the value of M.
- A) $M = \frac{RT}{mPV}$ B) $M = \frac{mPV}{RT}$ C) $M = \frac{mRT}{PV}$ D) $M = \frac{PV}{mRT}$
47. How many moles (n) of neon occupy a volume of 14.3 L at 273 K and 1 atm?
- A) 36.7 moles
 - B) 32.0 moles
 - C) 6.45 moles
 - D) 0.638 moles
 - E) 1.57 moles

48. How many moles of CaCl_2 are in 0.250 L of a 3.0 M CaCl_2 solution?

- A) 750 moles
- B) 1.3 moles
- C) 83 moles
- D) 0.75 mole
- E) 3.0 moles

49. Which of these is an acid in an aqueous solution?

- A) NaOH
- B) KCl
- C) HCl
- D) CH_4
- E) PCl_3

50. Which of these is a base in an aqueous solution?

- A) NaOH
- B) KCl
- C) HCl
- D) CH_4
- E) PCl_3

Answer Key

1. A
2. E
3. A
4. B
5. B
6. A
7. E
8. C
9. B
10. A
11. C
12. C
13. E
14. A
15. A
16. C
17. D
18. B
19. B
20. E
21. D
22. C
23. B
24. E
25. E
26. E
27. C
28. D
29. D
30. C
31. D
32. A
33. E
34. D
35. C
36. E
37. D
38. A
39. A
40. D
41. E
42. B
43. C
44. D
45. B

46. C
47. D
48. D
49. C
50. A