

Name Key E (Print last name in CAPS)SECTION 514-524 (same as your lab section)

1.	Read each question carefully before answering.
2.	Mark the choice that best answers the question or completes the statement.
3.	Use the scantron provided. Use a no. 2 pencil and clearly mark your choice. If you change an answer, completely erase your previous mark.
4.	Answer each question. There is no penalty for guessing. However, multiple answers are graded as incorrect, and blank answers are graded as incorrect.
5.	On the scantron, fill in your last name, first name and initial. Blacken the corresponding letters.
6.	Fill in your ID, the department=CHEM, Course no. = 101, and Section= your lab section. Blacken the corresponding letters and numbers.
7.	Use the test for scratch paper.
8.	Mark your answers on the test so you can check them with the key when it is posted.
9.	***Turning in a blank scantron results in a grade of zero.***
10.	You may be asked to turn in <u>both</u> the scantron and the exam, have your PHOTO ID and your calculator ready to be checked when you do so.
11.	Work at a steady pace and you will have ample time to finish.
12.	The keys will be posted on my class web page as soon as possible. You may check your grade at the class web site. Your password is the middle 5 numbers of your student ID followed by the first letter of your last name in CAPS. Be patient and give the webmaster time to enter all of this information.

There are 30 questions for 150 points. Good Luck!

E

Possibly Useful Information

$$M = \frac{\text{mol solute}}{\text{L soln}}$$

$$M_1V_1 = M_2V_2$$

$$\frac{w}{w} \% = \frac{\text{mass}}{\text{total mass}} \times 100$$

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

A periodic table is also provided on the last page of this exam.

Q.1 A certain formula of an ionic compound contains two K^+ cations and one anion. The anion could be...

- a) N^{3-} b) Cl^- c) Ne^- d) O^{2-} e) P^{3-}

Q.2 Which answer lists all the substances below that are **compounds** and not any elements or mixtures?

- I. ethyl alcohol
II. neon
III. sulfur
IV. water
V. crude oil

- a) I, II, and III
b) I, IV, V
c) IV and V
d) II, III, and V
e) I and IV

Q.3 How many moles of elemental bromine are there in 50.8 grams of elemental bromine?

- a) 0.318
b) 0.159
c) 3.14
d) 6.29
e) 1.63

$$Br_2 \quad \frac{50.8g}{2(79.90)} = 0.3178 \Rightarrow 0.318 \text{ mols } Br_2$$

Q.4 The element whose symbol is Cr is

- a) Cobalt
- b) Cadmium
- c) Cerium
- ☒ d) Chromium
- e) Curium

Q.5 Which of the following statements is false.

- a) Density is a physical property of matter. ✓
- b) Density multiplied by volume gives mass. ✓
- c) Mass divided by density gives volume. ✓
- ☒ d) Density is an extensive property of matter. X
- e) More than one of the above is false.

Q.6 What is the area in square millimeters of a rectangle that is 8.632 cm long and 26.41 mm wide?

- ☒ a) 2280 mm^2
 - b) 3.060 mm^2
 - c) 22.80 mm^2
 - d) 0.3060 mm^2
 - e) 30.60 mm^2
- $8.632 \text{ cm} \times \frac{10 \text{ mm}}{1 \text{ cm}} \times 26.41 \text{ mm} = 2.280 \times 10^3 \text{ mm}^2$

Q.7 Express the quantity 5.00 THz in MHz.

- a) $5.00 \times 10^{-6} \text{ MHz}$
 - ☒ b) $5.00 \times 10^6 \text{ MHz}$
 - c) $5.00 \times 10^3 \text{ MHz}$
 - d) $5.00 \times 10^{-3} \text{ MHz}$
 - e) $5.00 \times 10^9 \text{ MHz}$
- $5.00 \text{ THz} \times \frac{10^{12} \text{ Hz}}{1 \text{ THz}} \times \frac{1 \text{ MHz}}{10^6 \text{ Hz}} = 5.00 \times 10^6 \text{ MHz}$

Q.8 Caffeine, a stimulant in coffee and some cola drinks, is 49.47% carbon, 5.19% H, 28.8% N, 16.48% O. What is the mass of carbon contained in 37.1g of caffeine?

- ☒ a) 18.4 g
 - b) 36.8 g
 - c) 6.11 g
 - d) 1840 g
 - e) 24.3 g
- $37.1 \text{ g} \times 0.4947 = 18.35 \text{ g C} \Rightarrow 18.4 \text{ g}$

Q.9 When the prefix femto, f, is used in the metric system, the fundamental unit of measurement is multiplied by ...

- a) 10^{-9}
- b) 10^{-18}
- c) 10^{-12}
- d) 10^{-15}
- e) 10^9

Q.10 Bromine, a brick red liquid, has a specific gravity of 3.12. What is the volume occupied by 25.0 g of bromine?

- a) 11.7 mL
 - b) 78.0 mL
 - c) 32.6 mL
 - d) 8.01 mL
 - e) 2.48 mL
- $$\frac{25.0 \text{ g}}{3.12 \text{ g/mL}} = 8.01 \text{ mL}$$

Q.11 Some elements exist as diatomic species at room temperature and atmospheric pressure. Which of the following is not such an element?

- a) Hydrogen — H_2
- b) Bromine — Br_2
- c) Nitrogen — N_2
- d) Iodine — I_2
- e) Mercury — Hg

Q.12 Which element has a mass 7.30 times that of carbon-12?

- a) Mg
 - b) Sr
 - c) Ca
 - d) Br
 - e) Rb
- $$12.01 \times 7.30 = 87.67 \text{ amu}$$

closest is Sr

Q.13 Which of the following is incorrectly paired?

- a) combustion — exothermic process ✓
- b) carbon dioxide — pure substance ✓
- c) sugar dissolved in water — homogeneous mixture ✓
- d) energy that matter possesses by virtue of its position — kinetic energy X
- e) melting of ice — physical change ✓



Q.14 What is the mass of 2.2×10^9 molecules of CO_2 ?

- a) $9.7 \times 10^{10} \text{ g}$
 b) $1.0 \times 10^{-12} \text{ g}$
 c) $1.2 \times 10^6 \text{ g}$
 d) $4.4 \times 10^{-14} \text{ g}$
 (e) $1.6 \times 10^{-13} \text{ g}$
- Handwritten calculation:
 $2.2 \times 10^9 \text{ molecules} \times \frac{1 \text{ mol } \text{CO}_2}{6.022 \times 10^{23} \text{ molecules}} \times \frac{44.01 \text{ g } \text{CO}_2}{1 \text{ mol } \text{CO}_2} = 1.607 \times 10^{-13} \Rightarrow 1.6 \times 10^{-13} \text{ g } \text{CO}_2$

Q.15 A sample is marked as containing 58.2% barium carbonate. How many grams of the sample would contain 98.6 grams of barium carbonate?

- a) 424 g
 b) 115 g
 c) 157 g
 (d) 169 g
 e) 159 g
- Handwritten calculation:
 $58.2\% \times X = 98.6$
 $X = \frac{98.6}{0.582} = 169.41 \Rightarrow 169 \text{ g}$

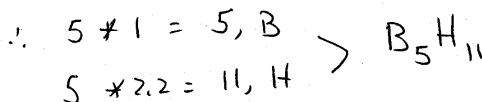
Q.16 Glucose has a molecular weight of 180.2 g and an empirical formula of CH_2O .

What is its molecular formula?

- a) $\text{C}_8\text{H}_{14}\text{O}_5$
 (b) $\text{C}_6\text{H}_{12}\text{O}_6$
 c) $\text{C}_{12}\text{H}_{22}\text{O}_{11}$
 d) $\text{C}_{10}\text{H}_{12}\text{O}_3$
 e) CH_2O
- Handwritten calculation:
 Molar mass $\text{CH}_2\text{O} = 12.01 + 2(1.008) + 16.00 = 30.03 \text{ amu}$
 $\frac{180.2}{30.03} = 6 \therefore 6 \times \text{CH}_2\text{O} = \text{C}_6\text{H}_{12}\text{O}_6$

Q.17 Boron may form a variety of hydrides. If a sample of a boron hydride is analyzed and found to contain 82.98% boron, the simplest formula for this sample is ...

- a) BH
 b) BH_3
 c) B_5H_9
 d) B_2H_6
 (e) B_5H_{11}
- Handwritten calculation:
 $\frac{82.98 \text{ g B}}{10.81 \text{ amu}} = 7.676 \text{ mol B} / 7.676 = 1, \text{ B}$
 $\frac{17.02 \text{ g H}}{1.008 \text{ amu}} = 16.884 \text{ mol H} / 7.676 = 2.2, \text{ H}$



Q.18 Which of the following contains 24 neutrons?

- a) $^{52}_{24}\text{Cr}$ b) $^{24}_{12}\text{Mg}$ c) $^{112}_{48}\text{Cd}$ d) $^{48}_{24}\text{Cr}$ e) $^{42}_{20}\text{Ca}$

Q.19 A proton...

- a) has zero charge and a mass of about 1 amu
b) equals the number of quarks in an atom
c) has the same mass as one atom of C-12
d) has a + charge and a mass of about 1 amu
e) has a negative charge and a mass of about 1 amu

Q.20 A dolomite ore contains 40.0% pure $\text{MgCO}_3 \cdot \text{CaCO}_3$. No other compounds of magnesium or calcium are present in this ore. What mass of magnesium and what mass of calcium are contained in 100.0 g of this ore?

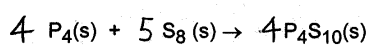
molar mass $\text{MgCO}_3 \cdot \text{CaCO}_3 = 184.41$ amu

- a) 18.3 g Mg – 21.7 g Ca $\% \text{Mg} = \frac{24.31}{184.41} \times 100 = 13.18 \%$
b) 7.91 g Mg – 13.0 g Ca
c) 8.70 g Mg – 31.3 g Ca
d) 5.27 g Mg – 8.69 g Ca $\% \text{Ca} = \frac{40.08}{184.41} \times 100 = 21.73 \%$
e) 34.5 g Mg – 5.30 g Ca

$$.1318 \times (40.0) = 5.27 \text{ g Mg}$$

$$.2173 \times (40.0) = 8.69 \text{ g Ca}$$

Q.21 When the following chemical reaction is balanced with the smallest integer coefficients, the sum of the coefficients is ...



$$4 + 5 + 4 = 13$$

- a) 3 b) 26 c) 8 d) 10 e) 13

Q.22 What mass of silver nitrate, AgNO_3 , is required to prepare 800. g of 3.50% solution of AgNO_3 ? molar mass $\text{AgNO}_3 = 169.9 \text{ amu}$

- a) 24.6 g
- b) 26.7 g
- c) 27.0 g
- d) 25.5 g
- e) 28.0 g

$$0.0350 \times 800. = 28.0 \text{ g } \text{AgNO}_3$$

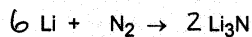
Q.23 How many mL of 1.00 M NaOH solution contains 20.0 g NaOH? molar mass NaOH = 40.0 amu

- a) 1000
- b) 500
- c) 750
- d) 1500
- e) 2000

$$\frac{20.0}{40.0} = \frac{1}{2} \text{ mol} \therefore 500 \text{ mL}$$
$$\frac{0.5 \text{ mol}}{1.00 \text{ mol/L}} = 0.5 \text{ L} =$$

Q.24 When the following chemical equation is balanced with the smallest whole number coefficients, the sum of the coefficients is...

- a) 7
- b) 4
- c) 6
- d) 8
- e) 9



$$6 + 1 + 2 = 9$$

Q.25 Determine the formula mass the following compound: $(\text{UO}_2)_3(\text{PO}_4)_2$?

- a) 418.0 amu
- b) 999.9 amu
- c) 285.0 amu
- d) 867.9 amu
- e) 570.0 amu

$$3 \times 238.0$$

$$6 \times 16.00$$

$$2 \times 30.97$$

$$8 \times 16.00$$

$$999.940 \text{ amu}$$

- Q.26 What is the molarity of a barium chloride solution prepared by dissolving 2.50 g $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$, in enough water to make 400. mL of solution?

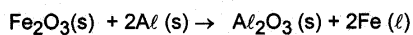
Molar mass $\text{BaCl}_2 \cdot 2\text{H}_2\text{O} = 244.4$ amu

- a) $2.56 \times 10^{-2}\text{M}$
 b) $4.97 \times 10^{-3}\text{M}$
 c) $4.09 \times 10^{-2}\text{M}$
 d) $7.31 \times 10^{-3}\text{M}$
 e) $5.20 \times 10^{-2}\text{M}$

$$M = \frac{\text{mol solute}}{L} = \frac{\frac{2.50}{244.4}}{0.400} = 0.02557$$

0.0256M
 $2.56 \times 10^{-2}\text{M}$

- Q.27 Consider the following balanced chemical reaction which occurs at high temperature:



If 150 g of Al and 250 g of Fe_2O_3 are placed in a reaction vessel at the appropriate temperature of the above reaction, how much elemental iron is produced?

molar mass $\text{Fe}_2\text{O}_3 = 159.7$ amu; molar mass $\text{Al}_2\text{O}_3 = 101.96$ amu

at. mass Al = 26.98 amu; at. mass Fe = 55.85 amu

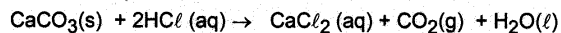
- a) 174g b) 311 g c) 400 g d) 5.56 g e) 17.4 g

$$\frac{150\text{ g Al}}{26.98} \times \frac{2\text{ Fe}}{2\text{ Al}} \times \frac{55.85\text{ g Fe}}{1\text{ mol Fe}} = 310.507\text{ g Fe}$$

$$\frac{250\text{ g Fe}_2\text{O}_3}{159.7} \times \frac{2\text{ Fe}}{1\text{ Fe}_2\text{O}_3} \times \frac{55.85\text{ g Fe}}{1\text{ mol Fe}} = 174.85\text{ g Fe}$$

↑
smallest

- Q.28 What mass of calcium carbonate, CaCO_3 , is required to react with 100. mL of 2.00 M HCl solution?

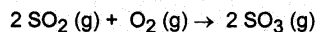


molar mass $\text{CaCO}_3 = 100.1 \text{ amu}$

a) 5.00 g
 b) 10.0 g
 c) 15.0 g
 d) 20.0 g
 e) 23.0 g

$$100 \text{ mL} \times \frac{2.00 \text{ mol HCl}}{1000 \text{ mL}} \times \frac{1 \text{ mol CaCO}_3}{2 \text{ mol HCl}} \times \frac{100.1 \text{ g CaCO}_3}{1 \text{ mol CaCO}_3} = 10.01 \Rightarrow 10.0 \text{ g}$$

- Q.29 Sulfur trioxide is made from, the oxidation of sulfur dioxide and is represented by the following balanced reaction:



A 16 g sample of SO_2 gives 18 g of SO_3 . What is the percent yield of SO_3 ?

molar mass $\text{SO}_2 = 64.0 \text{ amu}$; molar mass $\text{SO}_3 = 80.07 \text{ amu}$

- a) 60% b) 75% c) 80% d) 90% e) 100%

$$\frac{16.0 \text{ g SO}_2}{64.0} \times \frac{2 \text{ SO}_3}{2 \text{ SO}_2} \times \frac{80.07 \text{ g SO}_3}{1 \text{ mol SO}_3} = 20.01 \text{ g SO}_3 \text{ theoretical}$$

$$\% \text{ yield} = \frac{18}{20} \times 100 = 90\%$$

- Q.30 The symbols for a metal, a nonmetal, and a noble gas, in that order are ...

- a) Ag, Ga, Xe
 b) Ce, Ge, Ne
 c) Ca, Sn, Kr
 d) Ba, P, Ar
 e) P, Pb, Kr

End of Test

Q1	D
Q2	E
Q3	A
Q4	D
Q5	D
Q6	A
Q7	B
Q8	A
Q9	D
Q10	D
Q11	E
Q12	B
Q13	D
Q14	E
Q15	D
Q16	B
Q17	E
Q18	D
Q19	D
Q20	D
Q21	E
Q22	E
Q23	B
Q24	E
Q25	B
Q26	A
Q27	A
Q28	B
Q29	D
Q30	D