

Student Name (Print): \_\_\_\_\_

Student Signature: \_\_\_\_\_

Recitation Section Number:

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Recitation Instructor: \_\_\_\_\_

The exam booklet has 25 questions for credit and one additional question to check the color of your exam booklet. Please answer all 26 questions **on the OpScan sheet**. There is no penalty for guessing. Answer each question with the **best** choice from those provided. At the end of the 80-minute exam period, please hand in only *this* top sheet and your OpScan form. Please be sure to sign your name above your printed name on the OpScan form. If you finish early, please do not disturb your fellow students. A proctor will check your picture ID, OpScan form, signature and calculator during the exam. **The use of calculators with permanent memories (graphing calculators), cell phones, pagers, PDAs or other electronic devices other than a basic scientific calculator is expressly forbidden.** The last page of the booklet contains a periodic table along with other useful data. The use of any other notes or information on this test will be considered a violation of the Academic Honesty provisions of the student code. Exam scores will be posted as soon as possible.

ON THE OpScan FORM (Use a #2 pencil or darker)

- SIGN your name across the top of the form.
- Code the following information (**blacken** circles)  
Your Name (LAST NAME FIRST)  
Your RU ID  
[Start under Box **A** and continue to Box **I**]
- Your RECITATION SECTION NUMBER in **K & L**  
[Sections 01-08, code a 0 under box **K**]
- Your EXAM FORM NUMBER under box **P**

BL = Bryan Langowski, RP = Bob Porcja, JW = Judy Waidlich

Periods: 6 = 5:50 -6:45, 8 = 8:45-9:40

Sec	Per.	Instr
01	T6	JW
02	T6	RP
06	Th6	BL
07	Th6	JW
08	Th6	RP
10	T8	JW
11	T8	RP
12	T8	BL
13	Th8	JW
14	Th8	RP
15	Th8	BL

**Your EXAM FORM is: ①**

BEFORE STARTING THE EXAM PUT YOUR FORM # IN COLUMN P AND YOUR SECTION # IN COLUMN K AND L ON THE SCANTRON. ALSO DARKEN THE CIRCLES PLEASE.

- Decomposition of 0.44 mol HI produces  $H_2$  and  $I_2$ . The  $I_2$  produced is collected and it is all used to form  $PI_3$  from excess  $P_4$ . The amount of  $PI_3$  that forms is:
  - 0.15 mol  $PI_3$
  - 0.88 mol  $PI_3$
  - 0.57 mol  $PI_3$
  - 1.76 mol  $PI_3$
  - 0.66 mol  $PI_3$
  
- The mass number of an isotope is 208. It consists of 34 more neutrons than protons. How many protons does it have?
  - 123
  - 121
  - 85
  - 104
  - 87
  
- The density of lead is  $708 \text{ lb/ft}^3$ . What is this density expressed in base SI units?  
(1 lb = 454 g, 1 in = 0.0254 m, 1 ft = 12 in)
  - $1.14 \times 10^{-2} \text{ kg/cm}^3$
  - $1.14 \times 10^4 \text{ kg/m}^3$
  - $1.14 \times 10^7 \text{ g/m}^3$
  - $1.14 \times 10^3 \text{ kg/cm}^3$
  - $11.4 \text{ g/cm}^3$

4. Perform the following operation and choose the answer with the proper number of significant figures:

$$\frac{33.62 + 12.2 - 44.82}{26.4 \times 12.135}$$

- A. 0.0031  
B. 0.003  
C. 0.00312  
D. 0.003121  
E. 0.0031214
5. What is the mass of 232 molecules of dinitrogen tetroxide?
- A.  $2.13 \times 10^4$  g  
B.  $2.41 \times 10^{-20}$  g  
C. 92.0 g  
D.  $3.55 \times 10^{-20}$  g  
E.  $1.45 \times 10^4$  g
6. The formula for the ionic compound ammonium dichromate is  $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$ . The formula for cobalt (III) dichromate is therefore:
- A.  $\text{Co}_3(\text{Cr}_2\text{O}_7)_2$   
B.  $\text{Co}_2(\text{Cr}_2\text{O}_7)_3$   
C.  $\text{Co}_3\text{Cr}_2\text{O}_7$   
D.  $\text{Co}_2\text{Cr}_2\text{O}_7$   
E.  $\text{Co}(\text{Cr}_2\text{O}_7)_3$
7. The mass of an empty flask is 210.538 g and when filled with a liquid ( $d = 0.8540 \text{ g/cm}^3$ ) is 305.497 g. What will the mass of the flask be when filled with a liquid of density  $0.9120 \text{ g/cm}^3$ ?
- A. 316.5 g  
B. 350.4 g  
C. 326.1 g  
D. 321.7 g  
E. 311.9 g

8. The average atomic mass of a sample of Europium is 151.91 u. It consists of two isotopes; europium-151, with a mass of 150.92 and a fractional abundance of 0.4820 and europium-153. What is the mass of europium-153?
- A. 152.89 u
  - B. 153.04 u
  - C. 152.83 u
  - D. 152.75 u
  - E. 152.97 u
9. Which of the following statements describes a chemical property of chlorine?
- A. It is a yellowish-green gas.
  - B. It freezes at  $-101^{\circ}\text{C}$ .
  - C. It burns in sodium vapor.
  - D. It has a density of 3.17 g/L.
  - E. It has low solubility in water.
10. What is the total number of electrons in a  $\text{HPO}_4^{2-}$  ion?
- A. 50
  - B. 32
  - C. 94
  - D. 46
  - E. 98
11. When 31.6 g of a compound  $\text{XCl}_2$  is heated it decomposes completely to form 23.4 g of  $\text{Cl}_2$  (Atomic Weight:  $\text{Cl} = 35.45$ ). The atomic weight of X is
- A. 24.8
  - B. 49.6
  - C. 35.4
  - D. 12.4
  - E. 8.0

12. A sample of a compound containing only C and H is burned completely to form 9.94 g CO<sub>2</sub> and 3.05 g H<sub>2</sub>O. (Atomic Weights: H = 1.008, C = 12.01, O = 16.00) The empirical formula of the compound is
- A. CH
  - B. C<sub>2</sub>H<sub>2</sub>
  - C. C<sub>2</sub>H<sub>3</sub>
  - D. C<sub>3</sub>H<sub>4</sub>
  - E. C<sub>2</sub>H
13. Tantalum (Ta) forms the compound TaBr<sub>5</sub> when it reacts directly with Br<sub>2</sub>. (Atomic Weights: Ta = 180.9, Br = 79.90) The minimum mass of Br<sub>2</sub> required to react completely with 25.5 g of Ta is
- A. 56.3 g Br<sub>2</sub>
  - B. 22.5 g Br<sub>2</sub>
  - C. 28.1 g Br<sub>2</sub>
  - D. 72.2 g Br<sub>2</sub>
  - E. 112 g Br<sub>2</sub>
14. What is the volume of 0.200 M AgNO<sub>3</sub>(aq) required to react completely with 500.0 mL of 0.0250 M Na<sub>2</sub>CrO<sub>4</sub>(aq)?
- $$2\text{AgNO}_3(\text{aq}) + \text{Na}_2\text{CrO}_4(\text{aq}) \rightarrow \text{Ag}_2\text{CrO}_4(\text{s}) + 2\text{NaNO}_3(\text{aq})$$
- A. 125 mL
  - B. 150 mL
  - C. 175 mL
  - D. 200 mL
  - E. 250 mL
15. A hydrate of magnesium bromide is found to contain 37 % H<sub>2</sub>O by mass. What is its molecular formula?
- A. MgBr<sub>2</sub>·H<sub>2</sub>O
  - B. MgBr<sub>2</sub>·3H<sub>2</sub>O
  - C. MgBr<sub>2</sub>·4H<sub>2</sub>O
  - D. MgBr<sub>2</sub>·5H<sub>2</sub>O
  - E. MgBr<sub>2</sub>·6H<sub>2</sub>O

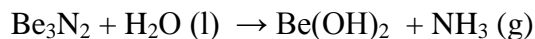
16. Predict the product formed when strontium, Sr, combines with phosphorus, P?

- A.  $\text{Sr}_3\text{P}_2$
- B.  $\text{Sr}_2\text{P}_3$
- C.  $\text{SrP}$
- D.  $\text{SrP}_2$
- E.  $\text{Sr}_2\text{P}$

17. Which of the following cannot be an empirical formula?

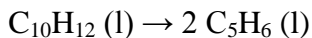
- A.  $\text{NO}_2$
- B.  $\text{H}_2\text{N}$
- C.  $\text{CH}$
- D.  $\text{CO}_2$
- E.  $\text{C}_3\text{H}_6$

18. When the following equation is balanced, what is the mole ratio of  $\text{H}_2\text{O}$  to  $\text{Be}_3\text{N}_2$ ?



- A. 3/1
- B. 3/2
- C. 2/3
- D. 6/1
- E. 1/3

19. The cracking of dicyclopentadiene to give cyclopentadiene is represented by the equation below. The densities of dicyclopentadiene and cyclopentadiene are 0.982 g/mL and 0.802 g/mL, respectively. How many mL of cyclopentadiene can be obtained from 20.0 mL of dicyclopentadiene?

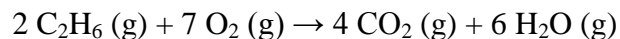


- A. 24.5 mL
- B. 20.0 mL
- C. 16.3 mL
- D. 10.0 mL
- E. 40.0 mL

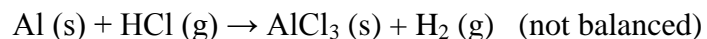
20. A solution of acetic acid,  $\text{CH}_3\text{COOH}$ , is 50.0%  $\text{CH}_3\text{CO}_2\text{H}$  by mass and has a density of 1.15 g/mL. Calculate the molarity of the solution.
- A. 9.58 M
  - B. 0.958 M
  - C. 7.25 M
  - D. 8.33 M
  - E. 12.0 M

21. What volume of 0.750 M  $\text{NH}_3$ , in L, would you use to prepare 0.500 L of 0.250 M  $\text{NH}_3$  solution?
- A. 0.167
  - B. 1.50
  - C. 6.00
  - D. 0.500
  - E. 0.250

22. What is the percent yield of the following reaction if 15 g  $\text{H}_2\text{O}$  are obtained from the combustion of 18 g  $\text{C}_2\text{H}_6$ ?



- A. 46 %
  - B. 67 %
  - C. 54 %
  - D. 40 %
  - E. 23 %
23. In the following reaction, how many moles of the non-limiting reactant are in excess if 3.50 mol Al are combined with 3.20 mol HCl?



- A. 2.43 mol
- B. 0.300 mol
- C. 2.03.mol
- D. 2.97.mol
- E. 2.70.mol

24. What is the mass of 10.0 molecules of water?

- A. 180 g
- B. 18.0 u
- C. 18.0 g
- D.  $2.99 \times 10^{-22}$  u
- E.  $2.99 \times 10^{-22}$  g

25. How many of the following statements is (are) false?

- i) Avogadro's number is equal to the number of entities in a mole of a substance.
- ii) A mole is an amount of a substance that contains as many entities as there are atoms in exactly one gram of carbon-12.
- iii) The molar mass of carbon-12 is 12 g/mol and the atomic mass of carbon-12 is 12 u.
- iv) The molecular formula of a compound is a multiple of the empirical formula of that compound.

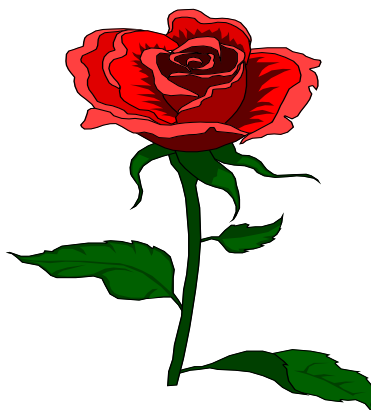
- A. 0
- B. 1
- C. 2
- D. 3
- E. 4

26. What is the color of your exam?

- A. White
- B. Yellow
- C. Pink
- D. Blue

**Useful formulae and constants**

$$N_A = 6.02 \times 10^{23} \text{ mol}^{-1} \quad ^\circ\text{C} = \frac{5}{9} (^\circ\text{F} - 32) \quad \text{K} = ^\circ\text{C} + 273.15$$



**HAPPY VALENTINE'S DAY!**