Answers

1] b 2]d 3]a 4]A 5]A 6]A 7]B 8]D 9]B
10] $D$ 11] B 12]E 13]D 14]E 15$] \mathrm{A}$

CLASS
TEST
DATE
ITEM ANALYSIS-



| 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 18 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\underset{\substack{1 \\ \mathbf{H} \\ 1.008}}{\substack{0 \\ \hline}}$ | 2 |  |  |  |  |  |  |  |  |  |  | 13 | 14 | 15 | 16 | 17 | $\begin{gathered} 2 \\ \mathrm{He} \\ 4.0026 \end{gathered}$ |
| $\begin{gathered} 3_{\mathbf{L i}}^{2} \\ 6.94 \end{gathered}$ | $\begin{gathered} 4 \\ \mathrm{Be} \\ 9.0122 \end{gathered}$ |  |  |  |  |  |  |  |  |  |  | $\begin{gathered} 5 \\ \mathbf{B} \\ 10.81 \\ \hline \end{gathered}$ | $\begin{array}{\|c\|} \hline 6 \\ \mathbf{C l}_{\mathbf{C}}^{\mathbf{C}} \\ \hline \end{array}$ | $\stackrel{7}{\stackrel{7}{\mathbf{N}}}$ | $\begin{gathered} 8 \\ \mathbf{0} \\ 15999 \\ \hline \end{gathered}$ | $\begin{gathered} 9 \\ \mathbf{F} \\ 18.998 \end{gathered}$ | $\begin{array}{\|c\|} \hline 10 \\ \mathrm{Ne} \\ 20.180 \end{array}$ |
| $\begin{gathered} 11 \\ \mathrm{Na} \\ 22.990 \end{gathered}$ | $\begin{gathered} \mathbf{1 2} \\ \mathbf{M g} \\ 24.305 \\ \hline \end{gathered}$ | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | $\begin{gathered} \hline 13 \\ \mathbf{A l} \\ 26.982 \end{gathered}$ | $\begin{array}{\|c\|} \hline 14 \\ \mathrm{Si} \\ 28.085 \end{array}$ | $\begin{gathered} 15 \\ \mathbf{P} \\ 30.974 \end{gathered}$ | $\begin{gathered} 16 \\ \mathbf{S} \\ 32.06 \end{gathered}$ | $\begin{gathered} \hline 17 \\ \stackrel{\mathrm{Cl}}{35.45} \end{gathered}$ | $\begin{gathered} \hline 18 \\ \mathbf{A r} \\ 39.948 \end{gathered}$ |
| $\begin{gathered} 19 \\ \mathbf{K} \\ 39.098 \end{gathered}$ | $\begin{gathered} 20 \\ \mathrm{Ca} \\ 40.078 \end{gathered}$ | $\begin{gathered} 21 \\ \stackrel{21}{\mathbf{S c}} \\ 44.956 \end{gathered}$ | $\begin{gathered} 22 \\ \mathbf{T i} \\ 47.867 \end{gathered}$ | $\begin{gathered} \stackrel{23}{\mathbf{V}}_{50.942} \end{gathered}$ | $\begin{gathered} 24 \\ \stackrel{24}{\mathbf{C r}} \\ 51.996 \end{gathered}$ | $\begin{gathered} 25 \\ \mathbf{M n} \\ 54.938 \end{gathered}$ | $\begin{gathered} 26 \\ \mathbf{F e} \\ 55.845 \end{gathered}$ | $\begin{gathered} 27 \\ \mathrm{Co} \\ 58.933 \end{gathered}$ | $\begin{gathered} \hline 28 \\ \stackrel{N i}{\mathrm{Ni}} \\ 58.693 \end{gathered}$ | $\underset{63.546}{29}$ | $\begin{gathered} 30 \\ \mathbf{Z n} \\ 65.38 \end{gathered}$ | $\begin{gathered} 31 \\ \mathbf{G a} \\ 69.723 \end{gathered}$ | $\begin{gathered} 32 \\ \mathbf{G e} \\ 72.630 \end{gathered}$ | $\begin{gathered} 33 \\ \mathbf{A s} \\ 74.922 \end{gathered}$ | $\begin{gathered} \hline 34 \\ \mathrm{Se} \\ 78.97 \end{gathered}$ | $\begin{gathered} 35 \\ \mathbf{B r} \\ 79.904 \end{gathered}$ | $\begin{gathered} 36 \\ \mathbf{K r} \\ 83.798 \end{gathered}$ |
| $\begin{gathered} 37 \\ \mathbf{R b} \\ 85,468 \end{gathered}$ | $\begin{gathered} \hline 38 \\ \mathbf{S r} \\ 87.62 \\ \hline \end{gathered}$ | $\begin{gathered} 39 \\ \mathbf{Y} \\ 88.906 \end{gathered}$ | $\begin{gathered} 40 \\ \mathbf{Z r} \\ 91.224 \end{gathered}$ | $\begin{gathered} 41 \\ \stackrel{41}{\mathbf{N b}} \\ 92.906 \end{gathered}$ | $\begin{gathered} \hline 42 \\ \text { Mo } \\ 95.95 \end{gathered}$ | $\begin{gathered} 43 \\ \mathbf{T c} \\ \text { (98) } \\ \hline \end{gathered}$ | $\begin{gathered} 44 \\ \mathbf{R u} \\ 101.07 \end{gathered}$ | $\begin{gathered} 45 \\ \mathbf{R h} \\ 102.91 \end{gathered}$ | $\begin{gathered} 46 \\ \text { Pd } \\ 106.42 \end{gathered}$ | $\begin{gathered} 47 \\ \mathbf{A g} \\ 107.87 \end{gathered}$ | $\begin{gathered} \hline 48 \\ \mathbf{C d} \\ 112.41 \end{gathered}$ | $\begin{array}{\|c\|} \hline 49 \\ \text { In } \\ 114.82 \\ \hline \end{array}$ | $\begin{gathered} \hline 50 \\ \mathbf{S n} \\ 118.71 \end{gathered}$ | $\begin{gathered} 51 \\ \mathbf{S b} \\ 121.76 \end{gathered}$ | $\begin{gathered} 52 \\ \mathrm{Te} \\ 127.60 \end{gathered}$ | $\begin{gathered} 53 \\ \text { I } \\ 126.90 \end{gathered}$ | $\begin{gathered} 54 \\ \mathbf{X e} \\ 131.29 \end{gathered}$ |
| $\begin{gathered} 55 \\ \text { Cs } \\ 132.91 \end{gathered}$ | $\begin{gathered} 56 \\ \text { Ba } \\ 137.33 \end{gathered}$ | $\underset{*}{57.71}$ | $\begin{gathered} 72 \\ \mathbf{H f} \\ 178.49 \end{gathered}$ | $\begin{gathered} 73 \\ \mathbf{T a} \\ 180.95 \end{gathered}$ | $\begin{gathered} 74 \\ \mathbf{W} \\ 183.84 \end{gathered}$ | $\begin{gathered} 75 \\ \mathbf{R e} \\ 186.21 \end{gathered}$ | $\begin{gathered} 76 \\ \text { Os } \\ 190.23 \end{gathered}$ | $\begin{gathered} 77 \\ \mathbf{I r} \\ 192.22 \end{gathered}$ | $\begin{gathered} 78 \\ \mathbf{P t} \\ 195.08 \end{gathered}$ | $\begin{gathered} 79 \\ \mathbf{A u} \\ 196.97 \end{gathered}$ | $\begin{array}{\|c\|} \hline 80 \\ \mathbf{H g} \\ 200.59 \end{array}$ | $\begin{gathered} \hline 81 \\ \mathbf{T l} \\ 204.38 \end{gathered}$ | $\begin{gathered} \hline 82 \\ \mathbf{P b} \\ 207.2 \end{gathered}$ | $\begin{gathered} 83 \\ \mathbf{B i} \\ 208.98 \end{gathered}$ | $\begin{gathered} 84 \\ \text { Po } \\ (209) \end{gathered}$ | $\begin{gathered} 85 \\ \text { At } \\ (210) \end{gathered}$ | $\begin{gathered} 86 \\ \mathbf{R n} \\ (222) \end{gathered}$ |
| $\begin{gathered} 87 \\ \mathbf{F r} \\ (223) \end{gathered}$ | $\begin{gathered} 88 \\ \text { Ra } \\ (226) \end{gathered}$ | $\begin{gathered} 89-103 \\ \# \end{gathered}$ | $\begin{gathered} 104 \\ \mathbf{R f} \\ (265) \end{gathered}$ | $\begin{gathered} 105 \\ \text { Db } \\ (268) \end{gathered}$ | $\begin{gathered} \hline 106 \\ \mathbf{S g} \\ (271) \\ \hline \end{gathered}$ | $\begin{array}{r} 107 \\ \text { Bh } \\ (270) \\ \hline \end{array}$ | $\begin{gathered} 108 \\ \mathbf{H s} \\ (277) \end{gathered}$ | $\begin{gathered} \hline 109 \\ \text { Mt } \\ (276) \\ \hline \end{gathered}$ | $\begin{gathered} \hline 110 \\ \text { Ds } \\ (281) \\ \hline \end{gathered}$ | $\begin{gathered} 111 \\ \mathbf{R g} \\ (280) \end{gathered}$ | $\begin{aligned} & \hline 112 \\ & \text { Cn } \\ & (285) \end{aligned}$ | $\begin{gathered} \hline 113 \\ \mathbf{N h} \\ (286) \\ \hline \end{gathered}$ | $\begin{array}{\|c\|} \hline 114 \\ \text { F1 } \\ (289) \end{array}$ | $\begin{gathered} 115 \\ \mathbf{M c} \\ (289) \end{gathered}$ | $\begin{gathered} 116 \\ \mathbf{L v} \\ (293) \end{gathered}$ | $\begin{gathered} \hline 117 \\ \mathrm{Ts} \\ (294) \\ \hline \end{gathered}$ | $\begin{gathered} \hline 118 \\ \mathbf{O g} \\ (294) \end{gathered}$ |
| * Lanthanideseries |  |  | $\begin{gathered} 57 \\ \mathbf{L a} \\ 138.91 \\ \hline \end{gathered}$ | $\begin{gathered} 58 \\ \mathrm{Ce} \\ 140.12 \\ \hline \end{gathered}$ | $\begin{gathered} 59 \\ \operatorname{Pr} \\ 140.91 \\ \hline \end{gathered}$ | $\begin{gathered} 60 \\ \text { Nd } \\ 144.24 \\ \hline \end{gathered}$ | $\begin{gathered} 61 \\ \mathbf{P m} \\ (145) \end{gathered}$ | $\begin{gathered} 62 \\ \mathrm{Sm} \\ 150.36 \end{gathered}$ | $\begin{gathered} 63 \\ \mathbf{E u} \\ 151.96 \\ \hline \end{gathered}$ | $\begin{gathered} 64 \\ \mathbf{G d} \\ 157.25 \\ \hline \end{gathered}$ | $\begin{gathered} 65 \\ \text { Tb } \\ 158.93 \\ \hline \end{gathered}$ | $\begin{gathered} 66 \\ \text { Dy } \\ 162.50 \\ \hline \end{gathered}$ | $\begin{gathered} 67 \\ \mathrm{Ho} \\ 164.93 \\ \hline \end{gathered}$ | $\begin{gathered} 68 \\ \mathbf{E r} \\ 167.26 \\ \hline \end{gathered}$ | $\begin{gathered} 69 \\ \mathbf{T m} \\ 168.93 \\ \hline \end{gathered}$ | $\begin{gathered} 70 \\ \mathbf{Y b} \\ 173.05 \\ \hline \end{gathered}$ | $\begin{gathered} 71 \\ \mathbf{L u} \\ 174.97 \\ \hline \end{gathered}$ |
| \# Actinideseries |  |  | $\begin{gathered} 89 \\ \mathbf{A c} \\ (227) \end{gathered}$ | $\begin{gathered} 90 \\ \text { Th } \\ \text { Th2.04 } \end{gathered}$ | $\begin{array}{c\|} \hline 91 \\ \mathbf{P a} \\ 231.04 \end{array}$ | $\begin{gathered} 92 \\ \mathbf{U} \\ 238.03 \end{gathered}$ | $\begin{gathered} 93 \\ \mathbf{N p} \\ (237) \end{gathered}$ | $\begin{gathered} 94 \\ \mathbf{P u} \\ (244) \end{gathered}$ | $\begin{gathered} 95 \\ \mathbf{A m} \\ (243) \end{gathered}$ | $\begin{gathered} 96 \\ \begin{array}{c} 96 \mathrm{~m} \\ (247) \end{array} \end{gathered}$ | $\begin{gathered} \hline 97 \\ \text { Bk } \\ (247) \end{gathered}$ | $\begin{gathered} 98 \\ \text { Cf } \\ (251) \end{gathered}$ | $\begin{gathered} 99 \\ \text { Es } \\ (252) \end{gathered}$ | $\begin{aligned} & \hline 100 \\ & \mathbf{F m} \\ & (257) \end{aligned}$ | $\begin{gathered} 101 \\ \mathbf{M d} \\ (258) \end{gathered}$ | $\begin{gathered} \hline 102 \\ \text { No } \\ (259) \end{gathered}$ | $\begin{array}{\|c\|} \hline 103 \\ \mathbf{L r} \\ (262) \end{array}$ |

$\mathrm{R}=8.314 \mathrm{~J} / \mathrm{K}-\mathrm{mol}=0.0821 \mathrm{I}-\mathrm{atm} / \mathrm{K}-\mathrm{mol}$

$$
\ln P=\frac{-\Delta H_{v a p}}{R T}+b \quad u=\sqrt{\frac{3 R T}{M}}
$$

## DO NOT OPEN THIS EXAM UNTIL YOU ARE INSTRUCTED TO DO SO

- Please print your name on the scantron
- Last Name, First Name
- That's all that's needed
- Sit in odd numbered seats.
- Books \& Bags in the front of the room.
- No text entry calculators.
- Use the exams as scratch paper.
- Keep the exams when you are done.
- Turn in the scantrons.

100 total points. Questions 1-15 worth 6.5 points each. Question 16 worth 2.5 points.

1. One mole of $\mathrm{H}_{2} \mathrm{~S}$ gas escapes from a container by effusion in 77 seconds. How long would it take for one mole of $\mathrm{NH}_{3}$ gas to escape from the same container?
a) 38.5 sec
b) 54 sec
c) 154 sec
d) 109 sec
e) 122 sec
2. Air in a sealed container is heated from $25^{\circ} \mathrm{C}$ to $36^{\circ} \mathrm{C}$. If the initial pressure is 3.80 atm , what is the final pressure?
a) 2.64 atm
b) 5.48 atm
c) 3.77 atm
d) 3.94 atm
e) 3.03 atm
3. A 6.60 g sample of a gaseous compound occupies a volume of 1.20 L at $27^{\circ} \mathrm{C}$ and 0.967 atm. What is molecular weight of this compound?
a) $140 \mathrm{~g} / \mathrm{mol}$
b) $165 \mathrm{~g} / \mathrm{mol}$
c) $152 \mathrm{~g} / \mathrm{mol}$
d) $109 \mathrm{~g} / \mathrm{mol}$
e) $123 \mathrm{~g} / \mathrm{mol}$
4. Using the graph below, determine the gas that has the lowest density (mass/vol.) at STP.

A) A
B) $B$
C) C
D) $D$
E) All of the gases have the same density at STP.
5. A mixture of 10.0 g of Ne and 10.0 g Ar have a total pressure of 1.6 atm . What is the partial pressure of Ne ?
A) 1.1 atm
B) 0.80 atm
C) 0.54 atm
D) 0.40 atm
E) 1.3 atm
6. A mixture of 1.0 mol He and 1.0 mol Ne are at STP in a rigid container. Which of the following statements is true?
A) Both gases have the same average kinetic energy.
B) Both gases contribute equally to the density of the mixture under these conditions.
C) Both gases have the same molecular speed.
D) The mixture has a volume of 22.4 L
E) All of the above are true.
7. Which one of these will diffuse the fastest at $25^{\circ} \mathrm{C}$ ?
A) 2.0 M Ar
B) $1.0 \mathrm{M} \mathrm{H}_{2}$
C) $2.0 \mathrm{M} \mathrm{N}_{2}$
D) 0.5 M Ne
E) $2.0 \mathrm{M} \mathrm{O}_{2}$
8. A container holds 3.0 g of hydrogen. If it is evacuated and filled with methane, $\mathrm{CH}_{4}$, at the same temperature and pressure, what mass of methane does it now hold?

| Atomic Molar Masses |  |
| :---: | :---: |
| C | $12.0 \mathrm{~g} \cdot \mathrm{~mol}^{-1}$ |
| H | $1.0 \mathrm{~g} \cdot \mathrm{~mol}^{-1}$ |

(A) 16 g
(B) 19 g
(C) 22.4 g
(D) 24 g
(E) 48 g
9. The STRONGEST intermolecular forces between molecules of $\mathrm{NH}_{3}$ are
a. ionic bonds.
b. hydrogen bonds.
c. ion-dipole attractions.
d. London forces.
e. covalent bonds.
10. The mass of $560 \mathrm{~cm}^{3}$ (STP) of an unknown gas is 1.60 g . This gas could be

|  | Molar Masses |
| :--- | :--- |
| $\mathrm{CO}_{2}$ | 44. $\mathrm{g} \cdot \mathrm{mol}^{-1}$ |
| $\mathrm{Cl}_{2}$ | 71. $\mathrm{g} \cdot \mathrm{mol}^{-1}$ |
| $\mathrm{O}_{2}$ | 32. $\mathrm{g} \cdot \mathrm{mol}^{-1}$ |
| $\mathrm{SO}_{2}$ | 64. $\mathrm{g} \cdot \mathrm{mol}^{-1}$ |

(A) oxygen.
(C) chlorine.
(B) carbon dioxide.
(D) sulfur dioxide.
11. Choose the substance with the lowest surface tension.
A) $\mathrm{CH}_{3} \mathrm{OH}$
B) $\mathrm{CH}_{3} \mathrm{CH}_{2} \mathrm{CH}_{2} \mathrm{CH}_{3}$
C) $\mathrm{CH}_{3} \mathrm{CH}_{2} \mathrm{OH}$
D) $\mathrm{H}_{2} \mathrm{O}$
E) $\left(\mathrm{CH}_{3}\right)_{2} \mathrm{CO}$
12. Place the following substances in order of increasing boiling point. $\mathrm{CH}_{3} \mathrm{CH}_{2} \mathrm{OH} \mathrm{He} \mathrm{CH}_{3} \mathrm{OCH}_{3}$
A) $\mathrm{He}<\mathrm{CH}_{3} \mathrm{CH}_{2} \mathrm{OH}<\mathrm{CH}_{3} \mathrm{OCH}_{3}$
B) $\mathrm{CH}_{3} \mathrm{CH}_{2} \mathrm{OH}<\mathrm{He}<\mathrm{CH}_{3} \mathrm{OCH}_{3}$
C) $\mathrm{CH}_{3} \mathrm{CH}_{2} \mathrm{OH}<\mathrm{CH}_{3} \mathrm{OCH}_{3}<\mathrm{He}$
D) $\mathrm{CH}_{3} \mathrm{OCH}_{3}<\mathrm{He}<\mathrm{CH}_{3} \mathrm{CH}_{2} \mathrm{OH}$
E) $\mathrm{He}<\mathrm{CH}_{3} \mathrm{OCH}_{3}<\mathrm{CH}_{3} \mathrm{CH}_{2} \mathrm{OH}$
13. Given that the boiling point of liquid is $166^{\circ} \mathrm{C}$ which of the following would be of most help for the calculation of its vapor pressure at $133^{\circ} \mathrm{C}$.
a) The Heat of Fusion
b) The Heat of Sublimation
c) The Heat of Ionization
d) The Heat of Condensation
e) The Heat of Racemization
14. Identify the compound that has hydrogen bonding.
A) $\left(\mathrm{CH}_{3}\right)_{3} \mathrm{~N}$
B) $\mathrm{N}_{2}$
C) $\mathrm{CH}_{3} \mathrm{CH}_{3}$
D) HI
E) $\mathrm{NH}_{3}$
15. Choose the pair of substances that are most likely to form a homogeneous solution.
A) $\mathrm{C}_{6} \mathrm{H}_{14}$ and $\mathrm{C}_{10} \mathrm{H}_{20}$
B) KCl and $\mathrm{C}_{5} \mathrm{H}_{12}$
C) $\mathrm{N}_{2} \mathrm{O}_{4}$ and $\mathrm{NH}_{4}$
D) $\mathrm{C}_{6} \mathrm{H}_{14}$ and $\mathrm{H}_{2} \mathrm{O}$
E) None of the pairs above will form a homogeneous solution.
16. My recitation meets at
a) $12: 30 \mathrm{pm}$ on Thursdays
b) $2: 30 \mathrm{pm}$ on Thursdays

