


Chemistry 12
Exam III Form A
July 29, 2005

Name _____
Section _____
Student No. _____

IMPORTANT: On the scantron (answer sheet), you **MUST** clearly fill your **name**, your **student number**, **section number**, and **test form** (white cover = test form A; yellow cover = test form B). Use a #2 pencil.

PENNSTATE University Testing Services Form 5CH84

 NAME _____

Print: _____
Name _____
Course _____
Date _____

* USE A NO. 2 PENCIL ONLY.
* MARK ONLY ONE ANSWER FOR EACH ITEM.

STUDENT NUMBER	SEC. NO	BOOK NO.	SCORE
0 0 0 0 0 0 0 0 0 0	0 0 0	0 0 0 0	0 0 0
1 1 1 1 1 1 1 1 1 1	1 1 1	1 1 1 1	1 1 1
2 2 2 2 2 2 2 2 2 2	2 2 2	2 2 2 2	2 2 2
3 3 3 3 3 3 3 3 3 3	3 3 3	3 3 3 3	3 3 3
4 4 4 4 4 4 4 4 4 4	4 4 4	4 4 4 4	4 4 4
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TEST FORM	A B C D E F G H I J
SPECIAL CODE	1 2 3 4

Code: Student Number _____
Section Number _____
Test Form _____

There are 25 questions on this exam. Check that you have done all of the problems and filled in the first 25 bubbles on the scantron. Your score will be reported in percents (max 100%).

Exam policy

- Calculators with text-programmable memory **are not** allowed.
- Relevant data and formulas, including the periodic table, are attached at the end of this exam.
- Your grade will be based only on what is on the scantron form.
- The answer key will be posted on the web after the exam (under "News").

Hints

- As you read the question, underline or circle key words to highlight them for yourself. Avoid errors from "mis-reading" the question.
- Pay attention to units and magnitudes (decimal places) of numbers obtained from calculations.
- There is no penalty for guessing.

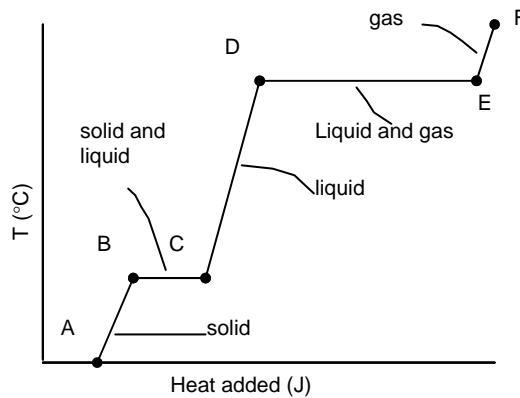
Chemistry 12 Exam 3

1.) Which one of the following substances has London dispersion forces as its only intermolecular force?

- a) CH_3OH
- b) NH_3
- c) H_2S
- d) CH_4
- e) HCl

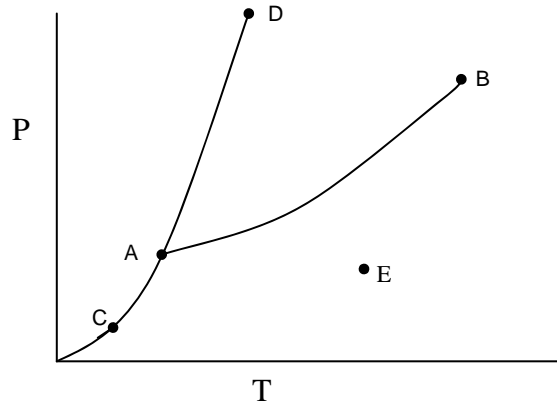
2.) The heating curve shown was generated by measuring the heat flow and temperature for a solid as it was heated. The slope of the _____ segment corresponds to the heat capacity of the liquid of the substance.

- a) AB
- b) BC
- c) CD
- d) DE
- e) EF



3.) On the phase diagram shown, the coordinates of point _____ correspond to the critical temperature and pressure.

- a) A
- b) B
- c) C
- d) D
- e) E



4.) Which of the following are indicative of a substance that has large intermolecular forces?

- i low vapor pressure
- ii high boiling point
- iii high heats of fusion and vaporization

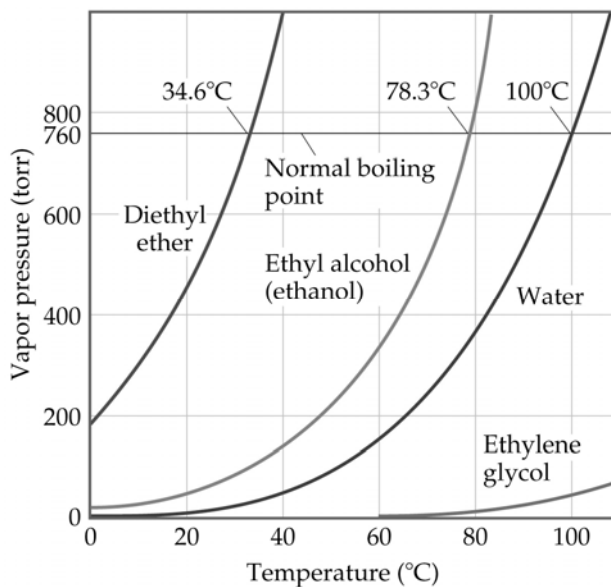
- a) i only
- b) ii only
- c) iii only
- d) i and iii
- e) all of the above

5.) Ethanol (C_2H_5OH) melts at $-114\text{ }^\circ\text{C}$. The enthalpy of fusion is 5.02 kJ/mol . The specific heats of solid and liquid ethanol are $0.97\text{ J/g}\cdot\text{K}$ and $2.3\text{ J/g}\cdot\text{K}$, respectively. How much heat (kJ) is needed to convert 25.0 g of solid ethanol at $-135\text{ }^\circ\text{C}$ to liquid ethanol at $-50\text{ }^\circ\text{C}$?

- a) 207.3 kJ
- b) -12.7 kJ
- c) 6.91 kJ
- d) 4192 kJ
- e) 9.21 kJ

6.) Based on the figure below, what is the boiling point of diethyl ether under an external pressure of 1.32 atm ?

- a) $0\text{ }^\circ\text{C}$
- b) $20\text{ }^\circ\text{C}$
- c) $34.6\text{ }^\circ\text{C}$
- d) $40\text{ }^\circ\text{C}$
- e) $78\text{ }^\circ\text{C}$



7.) Which solution contains the largest number of moles of chloride ions?

- a) 10.0 mL of 0.500 M BaCl_2
- b) 4.00 mL of 1.000 M NaCl
- c) 7.50 mL of 0.500 M FeCl_3
- d) 25.00 mL of 0.400 M KCl
- e) 30.00 mL of 0.100 M CaCl_2

8.) What mass (g) of potassium chloride is contained in 430 mL of a potassium chloride solution that has a chloride ion concentration of 0.193 M?

- a) 0.0643g
- b) 0.0830g
- c) 12.37g
- d) 0.386g
- e) 6.19g

9.) Which of the following are weak electrolytes?

- (i) HCl
- (ii) CH₃COOH (acetic acid)
- (iii) NH₃
- (iv) KCl

- a) HCl, KCl
- b) HCl, CH₃COOH, NH₃, KCl
- c) CH₃COOH, KCl
- d) CH₃COOH, NH₃
- e) HCl, CH₃COOH, KCl

10.) What is the total concentration of ions in a 0.250 M solution of HCl?

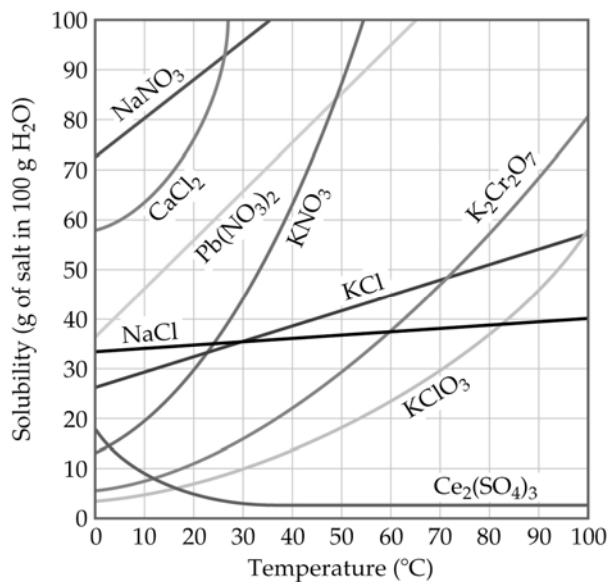
- a) essentially zero
- b) 0.125 M
- c) 0.250 M
- d) 0.500 M
- e) 0.750 M

11.) The solubility of Ar in water at 25 °C is 1.6×10^{-3} M when the pressure of the Ar above the solution is 1.0 atm. What is the solubility of Ar at a pressure of 2.5 atm?

- a) 1.6×10^3 M
- b) 6.4×10^{-4} M
- c) 4.0×10^{-3} M
- d) 7.5×10^{-2} M
- e) 1.6×10^{-3} M

- 12.) A sample of potassium nitrate (50.0 g) is dissolved in 100 g of water at 100 °C, with precautions taken to avoid evaporation of any water. The solution is cooled to 30.0 °C and no precipitate is observed. This solution is _____.

- hydrated
- placated
- saturated
- unsaturated
- supersaturated



- 13.) What is the mole fraction of urea (MW = 60.0 g/mol) in a solution prepared by dissolving 16 g of urea in 39 g of H₂O?

- 0.58
- 0.37
- 0.13
- 0.11
- 9.1

- 14.) A solution containing 10.0 g of an unknown liquid and 90.0 g water has a freezing point of -3.33 °C. Given $K_f = 1.86 \text{ }^\circ\text{C/m}$ for water, and assuming that the solute is a non electrolyte, what is the molar mass of the unknown liquid?

- 69.0 g/mol
- 333 g/mol
- 619 g/mol
- 161 g/mol
- 62.1 g/mol

- 15.) Calculate the freezing point of a 0.05500 m aqueous solution of NaNO₃. The molal freezing-point-depression constant of water is 1.86 °C/m.

- 0.0286°C
- 0.3069°C
- 0.1023°C
- 0.05627°C
- 0.2046°C

16.) The phrase “like dissolves like” refers to the fact that _____.

- a) gases can only dissolve other gases
- b) polar solvents dissolve polar solutes and nonpolar solvents dissolve nonpolar solutes
- c) solvents can only dissolve solutes of similar molar mass
- d) condensed phases can only dissolve other condensed phases
- e) polar solvents dissolve nonpolar solutes and vice versa

17.) Which one of the following substances is most likely to dissolve in CH₃OH?

- a) CCl₄
- b) Kr
- c) N₂
- d) CH₃CH₂OH
- e) H₂

18.) Which of the following aqueous solutions will have the highest boiling point?

- a) 0.10 m Na₂SO₄
- b) 0.20 m glucose
- c) 0.25 m sucrose
- d) 0.10 m NaCl
- e) 0.10 m SrSO₄

19.) What is the wavelength of a photon needed to photoionize O₂ in the upper atmosphere?



- a) 99.4 nm
- b) 165 nm
- c) 274 nm
- d) 0.399nm
- e) 39.9 nm

20.) The mole fraction of NO on a smoggy day is measured at 20 ppm. If barometric pressure is 732 torr, what is the partial pressure of NO in the atm?

- a) 146.4 torr
- b) 0.01464 torr
- c) 0.0366 torr
- d) 15.2 torr
- e) 36.6 torr

Proceed to last page 

Basic Skills

- 21.) What are the spectator ions in solution after the complete neutralization reaction occurs when mixing the strong acid $\text{HCl}(\text{aq})$ and the strong base $\text{Ba}(\text{OH})_2(\text{aq})$?
- H^+ , Cl^- , and OH^-
 - OH^- and Ba^{2+}
 - H^+ and OH^-
 - Ba^{2+} and Cl^-
 - Ba^{2+}
- 22.) Which of the following equations represents the proper net ionic equation for the precipitation of an insoluble phosphate compound from $\text{Pb}(\text{NO}_3)_2(\text{aq})$ and $\text{Na}_2\text{CO}_3(\text{aq})$?
- $\text{Pb}^{2+}(\text{aq}) + \text{CO}_3^{2-}(\text{aq}) \rightarrow \text{PbCO}_3(\text{s})$
 - $\text{Na}_2\text{CO}_3(\text{aq}) + \text{Pb}(\text{NO}_3)_2(\text{aq}) \rightarrow 2 \text{NaNO}_3(\text{aq}) + \text{PbCO}_3(\text{s})$
 - $\text{Na}_2\text{CO}_3(\text{aq}) + 2 \text{NO}_3^-(\text{aq}) \rightarrow 2 \text{NaNO}_3(\text{s}) + \text{CO}_3^{2-}(\text{aq})$
 - $\text{NO}_3^-(\text{aq}) + \text{Na}^+(\text{aq}) \rightarrow \text{NaNO}_3(\text{s})$
 - $\text{CO}_3^{2-}(\text{aq}) + \text{Pb}(\text{NO}_3)_2(\text{aq}) \rightarrow \text{PbCO}_3(\text{s}) + 2 \text{NO}_3^-(\text{aq})$
- 23.) What ions and/or molecules are present in relatively large proportions in a solution of the soluble ionic compound $\text{Ca}(\text{NO}_3)_2(\text{aq})$?
- Ca^+ and $(\text{NO}_3)_2^-$
 - Ca^+ and NO_3^-
 - $\text{Ca}(\text{NO}_3)_2$
 - Ca^{2+} and $(\text{NO}_3)_2^{2-}$
 - Ca^{2+} and NO_3^-
- 24.) A 20.0 mL sample of a solution of $\text{Pb}(\text{ClO}_3)_2$ was diluted with water to 55.0 mL. A 25.0 mL sample of the dilute solution was found to contain 0.025 moles of Pb^{2+} . What was the concentration of $\text{Pb}(\text{ClO}_3)_2$ in the original undiluted solution?
- 0.455M
 - 1.00 M
 - 1.25M
 - 1.37M
 - 2.75 M
- 25.) What is the concentration of ions in 15.00 mL of 0.0800 M Na_2SO_4 ?
- 0.240M
 - 0.080M
 - 0.560M
 - 1.20M
 - 3.60M

Form A

1. D
2. C
3. B
4. E
5. C
6. D
7. C
8. E
9. D
10. D
11. C
12. E
13. D
14. E
15. E
16. B
17. D
18. A
19. A
20. B
21. D
22. A
23. E
24. E
25. A