

CHE 113 2015 FA Final Exam

Your Name: _____

Your ID: _____

of Questions: 40

Date and Time of Exam Creation: Sun, Dec 13, 2015 @ 18:44:14

Total Exam Points: 40.00

PERIODIC TABLE OF THE ELEMENTS [1991 IUPAC Atomic Weights]																					
1 H 1.00794																	1 H 1.00794	2 He 4.002602			
3 Li 6.941	4 Be 9.012182															5 B 10.811	6 C 12.011	7 N 14.0074	8 O 15.9994	9 F 18.9984032	10 Ne 20.1797
11 Na 22.989768	12 Mg 24.3050											13 Al 26.981539	14 Si 28.0855	15 P 30.973762	16 S 32.066	17 Cl 35.4527	18 Ar 39.948				
19 K 39.0983	20 Ca 40.078	21 Sc 44.955910	22 Ti 47.88	23 V 50.9415	24 Cr 51.9961	25 Mn 54.93805	26 Fe 55.847	27 Co 58.93320	28 Ni 58.6934	29 Cu 63.546	30 Zn 65.39	31 Ga 69.723	32 Ge 72.61	33 As 74.92159	34 Se 78.96	35 Br 79.904	36 Kr 83.80				
37 Rb 85.4678	38 Sr 87.62	39 Y 88.90585	40 Zr 91.224	41 Nb 92.90638	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.90550	46 Pd 106.42	47 Ag 107.8682	48 Cd 112.411	49 In 114.818	50 Sn 118.710	51 Sb 121.757	52 Te 127.60	53 I 126.90447	54 Xe 131.29				
55 Cs 132.90543	56 Ba 137.327	57 La 138.90509	72 Hf 178.49	73 Ta 180.9479	74 W 183.84	75 Re 186.207	76 Os 190.23	77 Ir 192.22	78 Pt 195.08	79 Au 196.96654	80 Hg 200.59	81 Tl 204.3833	82 Pb 207.2	83 Bi 208.98037	84 Po (210)	85 At (210)	86 Rn (222)				
87 Fr (223)	88 Ra (226)	89 Ac (227)	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (262)	108 Hs (265)	109 Mt (266)	110	111	112										
Lanthanide Series		58 Ce 140.115	59 Pr 140.90765	60 Nd 144.24	61 Pm (146)	62 Sm 150.36	63 Eu 151.965	64 Gd 157.25	65 Tb 158.92534	66 Dy 162.50	67 Ho 164.93032	68 Er 167.26	69 Tm 168.93421	70 Yb 173.04	71 Lu 174.967						
Actinide Series		90 Th (232.0381)	91 Pa 231.03688	92 U 238.0289	93 Np (237)	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (262)						

Molar Volume of ideal gas at STP = 22.4 liter	Ideal Gas Constant: R = 8.314 J·K ⁻¹ ·mol ⁻¹	Speed of light, c = 3.00 × 10 ⁸ m·s ⁻¹
Faraday Constant, F = 9.6485 × 10 ⁴ C/mol electrons	R = 1.987 cal·K ⁻¹ ·mol ⁻¹	Rydberg Constant, R _H = 2.18 × 10 ⁻¹⁸ J
Avogadro's Number, N = 6.022 × 10 ²³ mol ⁻¹	R = 8.206 × 10 ⁻² liter·atm·K ⁻¹ ·mol ⁻¹	Electronic Charge, e = 1.602 × 10 ⁻¹⁹ C
Planck's Constant, h = 6.626 × 10 ⁻³⁴ J·s		Atomic mass unit, u = 1.6605 × 10 ⁻²⁴ g

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Question #: 1

What is the meaning of the blue square in the safety diamond?



- A. reactivity
- B. health
- C. fire
- D. specific hazards

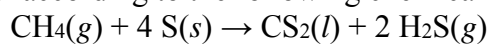
Question #: 2

After completing an experiment, all chemical wastes should be

- A. left at your lab station for the next class.
 - B. disposed of according to your instructor's directions.
 - C. dumped in the sink.
 - D. taken home.
-

Question #: 3

Carbon disulfide is a liquid that can be used in the production of rayon and cellophane. It is manufactured from methane and elemental sulfur according to the following chemical reaction:

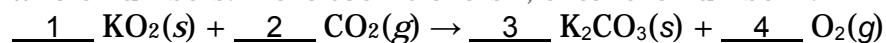


How many moles of CS₂ can be formed by the complete reaction of 10.6 mol of S with excess CH₄?

- A. 1 mol
 - B. 10.6 mol
 - C. 2.65 mol
 - D. 42.4 mol
-

Question #: 4

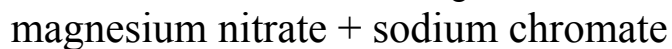
Balance the following chemical reaction by filling in the blank coefficients below with the smallest possible whole numbers. If the coefficient is 1, enter the number 1.



- 1. _____
 - 2. _____
 - 3. _____
 - 4. _____
-

Question #: 5

What is the net ionic equation for the reaction between the reagents shown below?



Complete the table shown below with your response. Give the cation first.

Substance	State		Substance	State		Substance	State
<u> 1 </u>	<u>(2)</u>	+	<u> 3 </u>	<u>(4)</u>	→	<u> 5 </u>	<u>(6)</u>

You do not need to balance the reaction. Enter ionic charges without superscripts; e.g., Ca²⁺.

1. _____
 2. _____
 3. _____
 4. _____
 5. _____
 6. _____
-

Question #: 6

Which of the following aqueous solutions would you use in a qualitative chemical test to identify a solution of Ba(OH)₂?

- A. BaCl₂
 - B. HNO₃
 - C. NH₃
 - D. H₂SO₄
-

Question #: 7

The phosphorus atom in PBr₃ has 1 lone pairs(s) and a 2 molecular geometry.

1. _____
 2. _____
-

Question #: 8

What are the appropriate hybridization schemes for the carbon atoms in molecular $\text{CH}_3\text{CO}_2\text{H}$?

- A. sp^3 and sp
 - B. sp^3 and sp^2
 - C. sp^2 and sp
 - D. sp^3 and sp^3
-

Question #: 9

What mass of ethylene glycol (antifreeze, MW = 62.1 g/mol) must be added to 10.0 liters of water to produce a solution that freezes at $-23.3\text{ }^\circ\text{C}$? The density of water is 1.00 g/mL and $K_f = 1.86\text{ }^\circ\text{C}/m$.

- A. 7.78 kg
 - B. 26.9 kg
 - C. 0.406 kg
 - D. 12.5 kg
-

Question #: 10

A solution was prepared by dissolving 9.54 g of dry ice (CO_2) in 250.0 mL ethanol ($\text{C}_2\text{H}_5\text{OH}$). The freezing point depression constant (K_f) for ethanol is $1.99\text{ }^\circ\text{C}/m$ and pure ethanol's freezing point is $-114.6\text{ }^\circ\text{C}$. The density of ethanol is 0.789 g/mL. How much did the dry ice depress ethanol's freezing point?

- A. $-114.6\text{ }^\circ\text{C}$
 - B. $0.197\text{ }^\circ\text{C}$
 - C. $-116.8\text{ }^\circ\text{C}$
 - D. $2.19\text{ }^\circ\text{C}$
-

Question #: 11

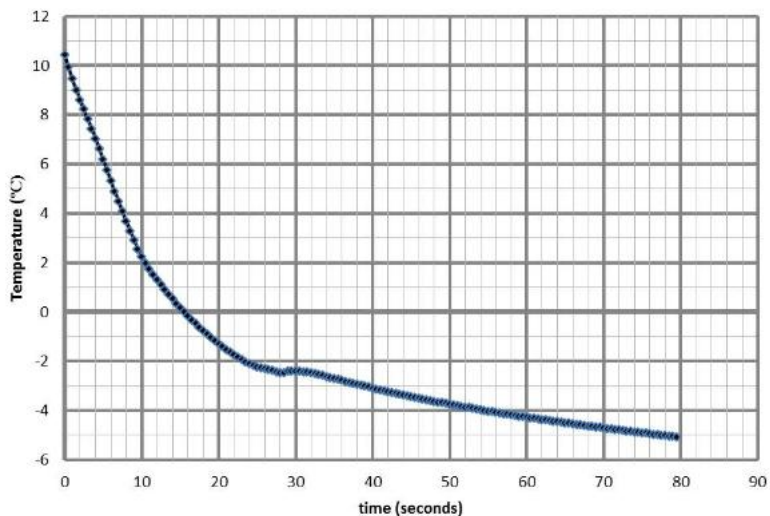
Which aqueous solution will have the lowest freezing point?

- A. 0.030 *m* glucose
 - B. 0.030 *m* AlBr_3
 - C. 0.030 *m* CaBr_2
 - D. 0.030 *m* NaBr
-

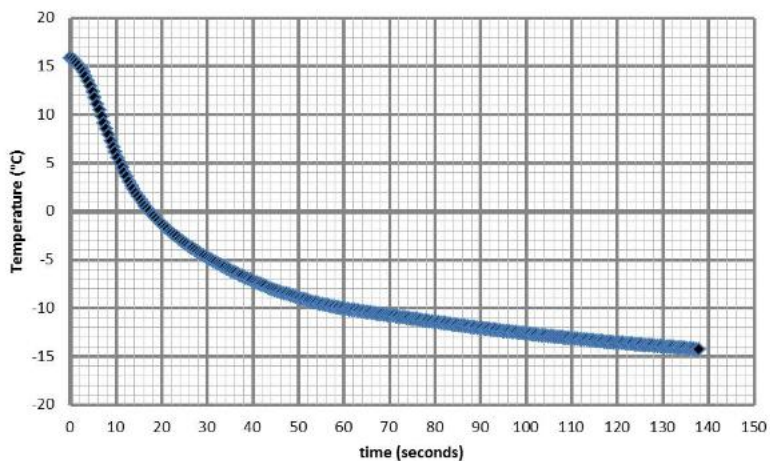
Question #: 12

A student prepared a sugar solution containing 6.0046 g of sugar ($C_{12}H_{22}O_{11}$) in 25.00 mL of water, and he/she produced the following freezing point data:

Freezing Point of Pure Water



Freezing Point of Sugar Solution



What is the K_f of water based on the student's data?

- A. $0.70\text{ }^{\circ}\text{C}/m$
- B. $9.3\text{ }^{\circ}\text{C}/m$
- C. $4.2\text{ }^{\circ}\text{C}/m$
- D. $0.11\text{ }^{\circ}\text{C}/m$

Question #: 13

A catalyst speeds up a reaction principally by _____.

- A. increasing T
 - B. increasing K
 - C. decreasing E_a
 - D. decreasing k
-

Question #: 14

A solution is said to contain 28% phosphoric acid by mass. What does that mean?

- A. the density of this solution is 2.8 g/mL
 - B. 100 g of this solution contains 28 g of phosphoric acid
 - C. 1 L of this solution has a mass of 28 g
 - D. 1 mL of this solution contains 28 g of phosphoric acid
-

Question #: 15

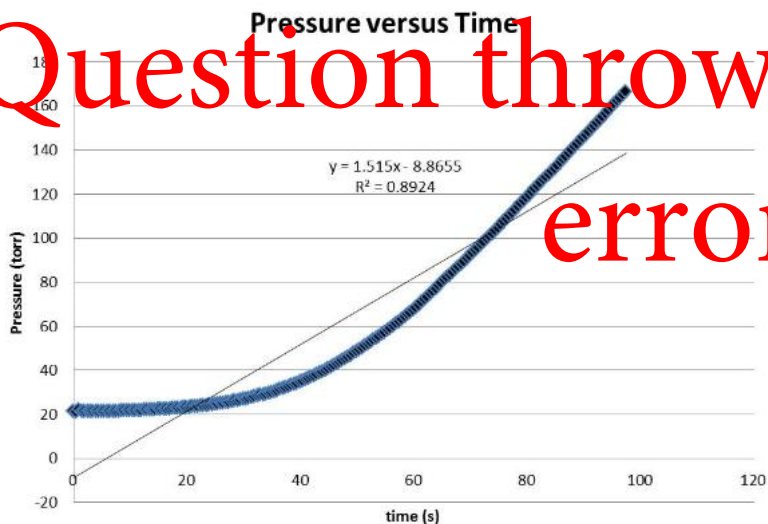
In order to determine the energy of activation for the decomposition of hydrogen peroxide, a student determined that the rate constant at 22.33 °C was 0.023 s⁻¹. At 33.96 °C, the rate constant increased to 0.061 s⁻¹. What is the activation energy?

- A. 63 kJ/mol
 - B. -8.1 kJ/mol
 - C. 7.4×10^2 kJ/mol
 - D. 1.3×10^{-3} kJ/mol
-

Question #: 16

In order to determine the rate law for the decomposition of hydrogen peroxide, a student collected pressure versus time measurements as the hydrogen peroxide decomposed with the addition of KI. The following graph was produced at 22.33 °C. What is the rate of the reaction?

Question thrown out due to error.



- A. $\frac{1.515 \text{ mol}}{\text{L} \times \text{s}}$
- B. $\frac{0.06248 \text{ mol}}{\text{L} \times \text{s}}$
- C. $\frac{8.865 \text{ mol}}{\text{L} \times \text{s}}$
- D. $\frac{0.02429 \text{ mol}}{\text{L} \times \text{s}}$
-

Question #: 17

Which one of the following is necessary to form a saturated solution at equilibrium?

- A. excess solute
 - B. an ionic solute
 - C. solute of low solubility
 - D. a Q less than K_{sp}
-

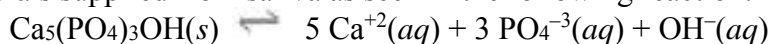
Question #: 18

The absorbance of a standard solution of 2.032×10^{-4} M $\text{FeSCN}^{+2}(aq)$ was determined to be 1.086. A student prepared a solution containing 4.98 mL of 0.00200 M $\text{Fe}(\text{NO}_3)_3$ and 3.97 mL of 0.00200 M KSCN in 1.00 mL water. What is the concentration of FeSCN^{+2} if its absorbance at equilibrium was measured to be 0.792?

- A. 6.75×10^4 M
 - B. 6.81×10^{-2} M
 - C. 2.03×10^{-4} M
 - D. 1.48×10^{-4} M
-

Question #: 19

Hydroxyapatite, $\text{Ca}_5(\text{PO}_4)_3\text{OH}$, is present in our tooth enamel. It undergoes continuous reversible reactions with the minerals supplied from saliva as seen in the following reaction:

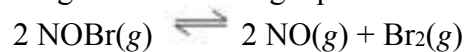


At equilibrium, the concentration of $\text{OH}^{-}(aq)$ is 2.00×10^{-4} mol/L. What is the value of K_{sp} ?

- A. 2.00×10^{-4}
 - B. 1.20×10^{-10}
 - C. 2.16×10^{-25}
 - D. 4.32×10^{-29}
-

Question #: 20

Nitrosyl bromide decomposes according to the following equation.

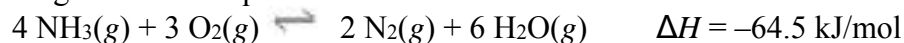


A 0.64 mol sample of NOBr was placed in a 1.00 L flask containing no NO or Br₂. At equilibrium, the flask contained 0.46 mol of NOBr. How many moles of NO and Br₂ are in the flask at equilibrium?

- A. 0.18 moles NO and 0.18 moles Br₂
 - B. 0.18 moles NO and 0.090 moles Br₂
 - C. 0.46 moles NO and 0.46 moles Br₂
 - D. 0.36 moles NO and 0.23 moles Br₂
-

Question #: 21

Consider the following reaction at equilibrium in a closed container

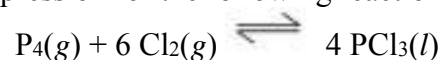


Increasing the O₂ partial pressure will _____ the NH₃ partial pressure.

- A. increase
 - B. decrease
 - C. not change
-

Question #: 22

What is the equilibrium constant expression for the following reaction?



A.

$$K = \frac{[\text{PCl}_3]}{[\text{P}_4][\text{Cl}_2]}$$

B.

$$K = \frac{[\text{PCl}_3]^4}{[\text{P}_4][\text{Cl}_2]^6}$$

C.

$$K = \frac{1}{[\text{P}_4][\text{Cl}_2]^6}$$

D.

$$K = \frac{1}{[\text{PCl}_3]^4}$$

Question #: 23

What is "hard water" used to commonly describe?

- A. water distilled from acid rain
 - B. groundwater found in arid areas
 - C. water with many dissolved ions
 - D. water from polluted water
-

Question #: 24

In order to produce a standard curve, you need to dilute a 12.0 M stock solution to produce 250.0 mL of a 6.41×10^{-2} M solution. How much of the stock solution do you need to use for the dilution?

- A. 0.0641 mL
 - B. 150. mL
 - C. 12.6 mL
 - D. 1.34 mL
-

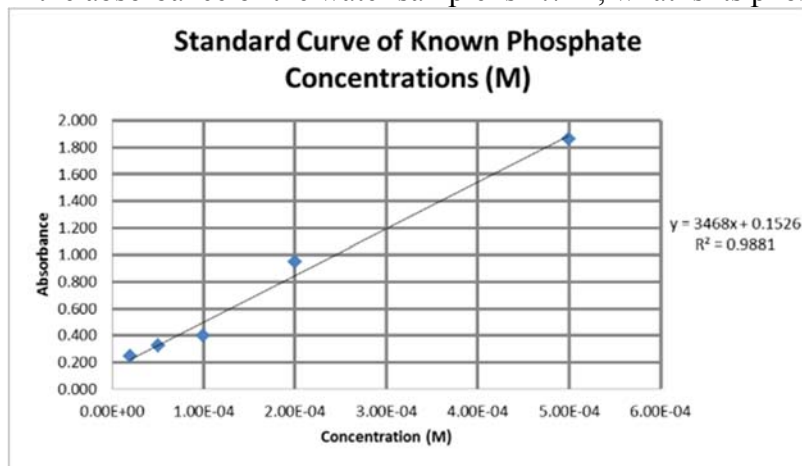
Question #: 25

For which of the following correlations would the data points be widely spread in a general straight line trend?

- A. $r^2 = 0.10$
 - B. $r^2 = 0.98$
 - C. $r^2 = 0.76$
 - D. $r^2 = 0.45$
-

Question #: 26

To determine the phosphate concentration in a water sample, the following standard curve was produced. If the absorbance of the water sample is 1.744, what is its phosphate concentration?



- A. 2.59×10^{-4} M
 - B. 5.09×10^{-4} M
 - C. 3.16×10^{-4} M
 - D. 4.59×10^{-4} M
-

Question #: 27

What is the pH of a 0.250 M solution of $\text{HNO}_3(aq)$?

- A. 0.60
 - B. 0.250
 - C. 13.75
 - D. 1.78
-

Question #: 28

What is the pH of a mixture of 0.100 M acetic acid and 0.200 M sodium acetate? The K_a of acetic acid is 1.8×10^{-5} . Your answer should be reported to 2 decimal places.

1

1. _____

Question #: 29

A buffer is prepared from succinic acid (H_2Suc , $K_a = 6.2 \times 10^{-5}$) and sodium succinate (HSuc^-) such that $[\text{H}_2\text{Suc}] = [\text{HSuc}^-] = 0.34 \text{ M}$. What is the pH of this buffer solution?

- A. 0.34
 - B. 4.21
 - C. 4.56
 - D. 0.467
-

Question #: 30

Which of the following pairs could make a 0.1 M buffer solution?

- A. HCl and NaOH
- B. KOH and NaCl
- C. NH_3 and NH_4Cl
- D. $\text{C}_2\text{H}_3\text{O}_2\text{H}$ and NaCl

Question #: 31

Which of the following acids, when paired with its conjugate base, would be appropriate to use to prepare a buffer with a pH of 5.02?

- A. HCOOH , $K_a = 1.77 \times 10^{-4}$
 - B. H_3PO_4 , $K_a = 7.52 \times 10^{-3}$
 - C. $\text{NaH}_2\text{PO}_4 \cdot \text{H}_2\text{O}$, $K_a = 6.23 \times 10^{-8}$
 - D. $\text{CH}_3\text{CH}_2\text{COOH}$, $K_a = 1.34 \times 10^{-5}$
-

Question #: 32

What is the molar solubility of calcium phosphate, whose K_{sp} is 2.07×10^{-33} ?

- A. $2.07 \times 10^{-6} \text{ M}$
 - B. $2.03 \times 10^{-7} \text{ M}$
 - C. $3.45 \times 10^{-35} \text{ M}$
 - D. $1.14 \times 10^{-7} \text{ M}$
-

Question #: 33

In the standardization of hydrochloric acid with sodium carbonate, how many equivalence points should you see?

- A. one
 - B. two
 - C. three
 - D. four
-

Question #: 34

For the determination of the solubility of calcium carbonate lab, the sodium carbonate used in the experiment was placed in the oven prior to using it to titrate the hydrochloric acid solution. Why was this necessary?

- A. To ensure the sodium carbonate was not contaminated with hydrochloric acid.
- B. To remove any water.
- C. To heat the sample up.
- D. To keep the sodium carbonate out of the light.

Question #: 35

How would the concentration of $\text{Fe}^{+2}(\text{aq})$ ions in equilibrium with FeS be affected if the concentration of $\text{S}^{2-}(\text{aq})$ ions were tripled?

- A. increased by a factor of 6
 - B. no change
 - C. decreased by a factor 30
 - D. decreased by a factor of 3
-

Question #: 36

Which of the following best represents the solubility product expression for the dissociation of strontium phosphate?

A. $K_{\text{sp}} = [\text{Sr}^{+2}]^2[\text{PO}_4^{-3}]^3$

B.

$$K_{\text{sp}} = \frac{[\text{Sr}^{+2}]^3[\text{PO}_4^{-3}]^2}{[\text{Sr}_3(\text{PO}_4)_2]}$$

C. $K_{\text{sp}} = [\text{Sr}^{+2}]^3[\text{PO}_4^{-3}]^2$

D. $K_{\text{sp}} = [\text{Sr}^{+2}][\text{PO}_4^{-3}]$

Question #: 37

What result would you expect from a pH paper test of a solution of $\text{Ba}(\text{OH})_2$?

- A. pH paper will turn blue
 - B. pH paper will turn red
 - C. there will be no change in the color of the pH paper
 - D. pH paper will turn green
-

Question #: 38

In lab, you conducted a vinegar test by adding 10 to 20 drops of vinegar directly to a solid sample. What were you testing for in this reaction?

- A. The presence of acetic acid.
 - B. The formation of an insoluble hydroxide.
 - C. The presence of base.
 - D. The formation of carbon dioxide.
-

Question #: 39

Which of the following substances would produce an orange flame in the flame test?

- A. boric acid
 - B. sodium chloride
 - C. sucrose
 - D. magnesium sulfate
-

Question #: 40

Various qualitative tests were performed on an unknown sample and the following results were obtained:

1. The unknown was soluble in water.
2. Its aqueous solutions had a pH ranging from 10 to 12.
3. It bubbled in vinegar.

Based on this information, what is the identity of the unknown?

- A. sucrose
- B. sodium hydroxide
- C. sodium carbonate
- D. magnesium sulfate

CHE 113 2015 FA Final Exam - Key

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Faraday Constant, F = 9.6485 × 10 ⁴ C/mol electrons	R = 1.987 cal·K ⁻¹ ·mol ⁻¹	Rydberg Constant, R _H = 2.18 × 10 ¹⁸ J
Avogadro's Number, N = 6.022 × 10 ²³ mol ⁻¹	R = 8.206 × 10 ⁻² liter·atm·K ⁻¹ ·mol ⁻¹	Electronic Charge, e = 1.602 × 10 ⁻¹⁹ C
Planck's Constant, h = 6.626 × 10 ⁻³⁴ J·s		Atomic mass unit, u = 1.6605 × 10 ⁻²⁴ g

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Question #: 1

What is the meaning of the blue square in the safety diamond?



- A. reactivity
- B. health
- C. fire
- D. specific hazards

Item Weight: 1.0

Question #: 2

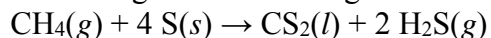
After completing an experiment, all chemical wastes should be

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- ✓B. disposed of according to your instructor's directions.
- C. dumped in the sink.
- D. taken home.

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Question #: 3

Carbon disulfide is a liquid that can be used in the production of rayon and cellophane. It is manufactured from methane and elemental sulfur according to the following chemical reaction:



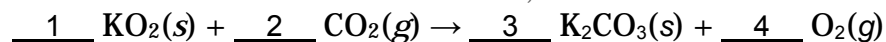
How many moles of CS₂ can be formed by the complete reaction of 10.6 mol of S with excess CH₄?

- A. 1 mol
- B. 10.6 mol
- ✓C. 2.65 mol
- D. 42.4 mol

Item Weight: 1.0

Question #: 4

Balance the following chemical reaction by filling in the blank coefficients below with the smallest possible whole numbers. If the coefficient is 1, enter the number 1.



- 1. 4
- 2. 2
- 3. 2
- 4. 3

Item Weight: 1.0

Question #: 5

What is the net ionic equation for the reaction between the reagents shown below?

magnesium nitrate + sodium chromate

Complete the table shown below with your response. Give the cation first.

Substance	State		Substance	State		Substance	State
<u> 1 </u>	<u>(2)</u>	+	<u> 3 </u>	<u>(4)</u>	→	<u> 5 </u>	<u>(6)</u>

You do not need to balance the reaction. Enter ionic charges without superscripts; e.g., Ca²⁺.

1. Mg+2|Mg2+|Mg^+2|Mg^2+|
2. aq|aqueous|
3. CrO4-2|CrO42-|CrO4^-2|CrO4^2-|
4. aq|aqueous|
5. MgCrO4
6. s|solid|

Item Weight: 1.0

Question #: 6

Which of the following aqueous solutions would you use in a qualitative chemical test to identify a solution of Ba(OH)₂?

- A. BaCl₂
- B. HNO₃
- C. NH₃
- ✓D. H₂SO₄

Item Weight: 1.0

Question #: 7

The phosphorus atom in PBr₃ has 1 lone pairs(s) and a 2 molecular geometry.

1. 1|one|
2. trigonal pyramidal

Item Weight: 1.0

Question #: 8

What are the appropriate hybridization schemes for the carbon atoms in molecular $\text{CH}_3\text{CO}_2\text{H}$?

- A. sp^3 and sp
- ✓B. sp^3 and sp^2
- C. sp^2 and sp
- D. sp^3 and sp^3

Item Weight: 1.0

Question #: 9

What mass of ethylene glycol (antifreeze, MW = 62.1 g/mol) must be added to 10.0 liters of water to produce a solution that freezes at $-23.3\text{ }^\circ\text{C}$? The density of water is 1.00 g/mL and $K_f = 1.86\text{ }^\circ\text{C}/m$.

- ✓A. 7.78 kg
- B. 26.9 kg
- C. 0.406 kg
- D. 12.5 kg

Item Weight: 1.0

Question #: 10

A solution was prepared by dissolving 9.54 g of dry ice (CO_2) in 250.0 mL ethanol ($\text{C}_2\text{H}_5\text{OH}$). The freezing point depression constant (K_f) for ethanol is $1.99\text{ }^\circ\text{C}/m$ and pure ethanol's freezing point is $-114.6\text{ }^\circ\text{C}$. The density of ethanol is 0.789 g/mL. How much did the dry ice depress ethanol's freezing point?

- A. $-114.6\text{ }^\circ\text{C}$
- B. $0.197\text{ }^\circ\text{C}$
- C. $-116.8\text{ }^\circ\text{C}$
- ✓D. $2.19\text{ }^\circ\text{C}$

Item Weight: 1.0

Question #: 11

Which aqueous solution will have the lowest freezing point?

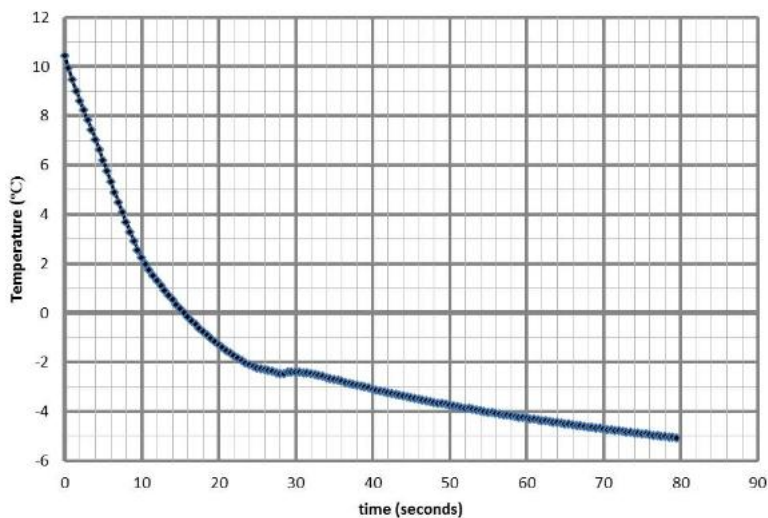
- A. 0.030 *m* glucose
- ✓B. 0.030 *m* AlBr_3
- C. 0.030 *m* CaBr_2
- D. 0.030 *m* NaBr

Item Weight: 1.0

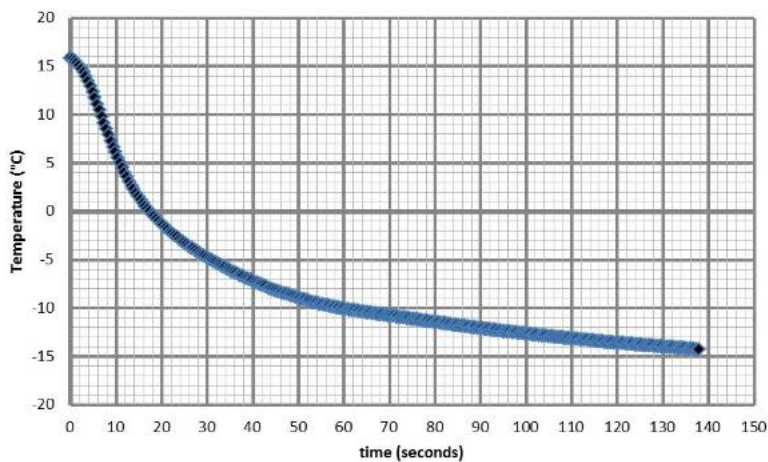
Question #: 12

A student prepared a sugar solution containing 6.0046 g of sugar ($C_{12}H_{22}O_{11}$) in 25.00 mL of water, and he/she produced the following freezing point data:

Freezing Point of Pure Water



Freezing Point of Sugar Solution



What is the K_f of water based on the student's data?

- A. $0.70\text{ }^{\circ}\text{C}/m$
- ✓ B. $9.3\text{ }^{\circ}\text{C}/m$
- C. $4.2\text{ }^{\circ}\text{C}/m$
- D. $0.11\text{ }^{\circ}\text{C}/m$

Item Weight: 1.0

Question #: 13

A catalyst speeds up a reaction principally by _____.

- A. increasing T
- B. increasing K
- ✓C. decreasing E_a
- D. decreasing k

Item Weight: 1.0

Question #: 14

A solution is said to contain 28% phosphoric acid by mass. What does that mean?

- A. the density of this solution is 2.8 g/mL
- ✓B. 100 g of this solution contains 28 g of phosphoric acid
- C. 1 L of this solution has a mass of 28 g
- D. 1 mL of this solution contains 28 g of phosphoric acid

Item Weight: 1.0

Question #: 15

In order to determine the energy of activation for the decomposition of hydrogen peroxide, a student determined that the rate constant at 22.33 °C was 0.023 s⁻¹. At 33.96 °C, the rate constant increased to 0.061 s⁻¹. What is the activation energy?

- ✓A. 63 kJ/mol
- B. -8.1 kJ/mol
- C. 7.4×10^2 kJ/mol
- D. 1.3×10^{-3} kJ/mol

Item Weight: 1.0

Question #: 16

In order to determine the rate law for the decomposition of hydrogen peroxide, a student collected pressure versus time measurements as the hydrogen peroxide decomposed with the addition of KI. The following graph was produced at 22.33 °C. What is the rate of the reaction?



- A. $\frac{1.515 \text{ mol}}{\text{L} \times \text{s}}$
- B. $\frac{0.06248 \text{ mol}}{\text{L} \times \text{s}}$
- C. $\frac{8.865 \text{ mol}}{\text{L} \times \text{s}}$
- ✓D. $\frac{0.02429 \text{ mol}}{\text{L} \times \text{s}}$

Item Weight: 1.0

Question #: 17

Which one of the following is necessary to form a saturated solution at equilibrium?

- ✓A. excess solute
- B. an ionic solute
- C. solute of low solubility
- D. a Q less than K_{sp}

Item Weight: 1.0

Question #: 18

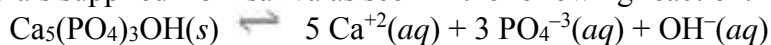
The absorbance of a standard solution of 2.032×10^{-4} M FeSCN^{+2} (aq) was determined to be 1.086. A student prepared a solution containing 4.98 mL of 0.00200 M $\text{Fe}(\text{NO}_3)_3$ and 3.97 mL of 0.00200 M KSCN in 1.00 mL water. What is the concentration of FeSCN^{+2} if its absorbance at equilibrium was measured to be 0.792?

- A. 6.75×10^4 M
- B. 6.81×10^{-2} M
- C. 2.03×10^{-4} M
- ✓D. 1.48×10^{-4} M

Item Weight: 1.0

Question #: 19

Hydroxyapatite, $\text{Ca}_5(\text{PO}_4)_3\text{OH}$, is present in our tooth enamel. It undergoes continuous reversible reactions with the minerals supplied from saliva as seen in the following reaction:



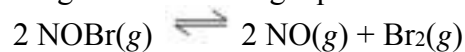
At equilibrium, the concentration of $\text{OH}^{-}(aq)$ is 2.00×10^{-4} mol/L. What is the value of K_{sp} ?

- A. 2.00×10^{-4}
- B. 1.20×10^{-10}
- C. 2.16×10^{-25}
- ✓D. 4.32×10^{-29}

Item Weight: 1.0

Question #: 20

Nitrosyl bromide decomposes according to the following equation.



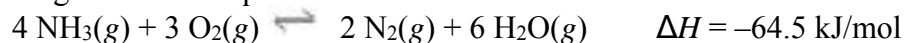
A 0.64 mol sample of NOBr was placed in a 1.00 L flask containing no NO or Br₂. At equilibrium, the flask contained 0.46 mol of NOBr. How many moles of NO and Br₂ are in the flask at equilibrium?

- A. 0.18 moles NO and 0.18 moles Br₂
- ✓B. 0.18 moles NO and 0.090 moles Br₂
- C. 0.46 moles NO and 0.46 moles Br₂
- D. 0.36 moles NO and 0.23 moles Br₂

Item Weight: 1.0

Question #: 21

Consider the following reaction at equilibrium in a closed container



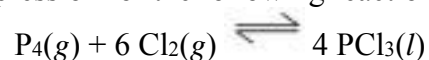
Increasing the O₂ partial pressure will _____ the NH₃ partial pressure.

- A. increase
- ✓B. decrease
- C. not change

Item Weight: 1.0

Question #: 22

What is the equilibrium constant expression for the following reaction?



A.

$$K = \frac{[\text{PCl}_3]}{[\text{P}_4][\text{Cl}_2]}$$

B.

$$K = \frac{[\text{PCl}_3]^4}{[\text{P}_4][\text{Cl}_2]^6}$$

✓C.

$$K = \frac{1}{[\text{P}_4][\text{Cl}_2]^6}$$

D.

$$K = \frac{1}{[\text{PCl}_3]^4}$$

Item Weight: 1.0

Question #: 23

What is "hard water" used to commonly describe?

A. water distilled from acid rain

B. groundwater found in arid areas

✓C. water with many dissolved ions

D. water from polluted water

Item Weight: 1.0

Question #: 24

In order to produce a standard curve, you need to dilute a 12.0 M stock solution to produce 250.0 mL of a 6.41×10^{-2} M solution. How much of the stock solution do you need to use for the dilution?

- A. 0.0641 mL
- B. 150. mL
- C. 12.6 mL
- ✓D. 1.34 mL

Item Weight: 1.0

Question #: 25

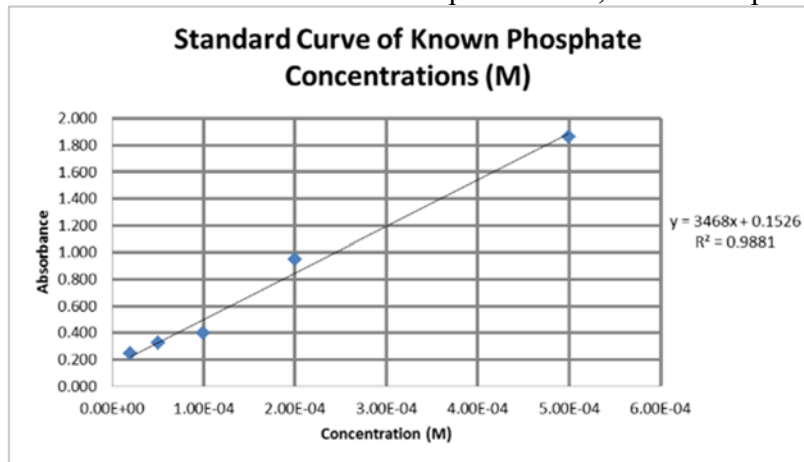
For which of the following correlations would the data points be widely spread in a general straight line trend?

- ✓A. $r^2 = 0.10$
- B. $r^2 = 0.98$
- C. $r^2 = 0.76$
- D. $r^2 = 0.45$

Item Weight: 1.0

Question #: 26

To determine the phosphate concentration in a water sample, the following standard curve was produced. If the absorbance of the water sample is 1.744, what is its phosphate concentration?



- A. 2.59×10^{-4} M
- B. 5.09×10^{-4} M
- C. 3.16×10^{-4} M
- ✓D. 4.59×10^{-4} M

Item Weight: 1.0

Question #: 27

What is the pH of a 0.250 M solution of $\text{HNO}_3(aq)$?

- ✓A. 0.60
- B. 0.250
- C. 13.75
- D. 1.78

Item Weight: 1.0

Question #: 28

What is the pH of a mixture of 0.100 M acetic acid and 0.200 M sodium acetate? The K_a of acetic acid is 1.8×10^{-5} . Your answer should be reported to 2 decimal places.

1

1. 5.05

Item Weight: 1.0

Question #: 29

A buffer is prepared from succinic acid (H_2Suc , $K_a = 6.2 \times 10^{-5}$) and sodium succinate (HSuc^-) such that $[\text{H}_2\text{Suc}] = [\text{HSuc}^-] = 0.34 \text{ M}$. What is the pH of this buffer solution?

- A. 0.34
- ✓B. 4.21
- C. 4.56
- D. 0.467

Item Weight: 1.0

Question #: 30

Which of the following pairs could make a 0.1 M buffer solution?

- A. HCl and NaOH
- B. KOH and NaCl
- ✓C. NH_3 and NH_4Cl
- D. $\text{C}_2\text{H}_3\text{O}_2\text{H}$ and NaCl

Item Weight: 1.0

Question #: 31

Which of the following acids, when paired with its conjugate base, would be appropriate to use to prepare a buffer with a pH of 5.02?

- A. HCOOH , $K_a = 1.77 \times 10^{-4}$
- B. H_3PO_4 , $K_a = 7.52 \times 10^{-3}$
- C. $\text{NaH}_2\text{PO}_4 \cdot \text{H}_2\text{O}$, $K_a = 6.23 \times 10^{-8}$
- ✓D. $\text{CH}_3\text{CH}_2\text{COOH}$, $K_a = 1.34 \times 10^{-5}$

Item Weight: 1.0

Question #: 32

What is the molar solubility of calcium phosphate, whose K_{sp} is 2.07×10^{-33} ?

- A. 2.07×10^{-6} M
- B. 2.03×10^{-7} M
- C. 3.45×10^{-35} M
- ✓D. 1.14×10^{-7} M

Item Weight: 1.0

Question #: 33

In the standardization of hydrochloric acid with sodium carbonate, how many equivalence points should you see?

- A. one
- ✓B. two
- C. three
- D. four

Item Weight: 1.0

Question #: 34

For the determination of the solubility of calcium carbonate lab, the sodium carbonate used in the experiment was placed in the oven prior to using it to titrate the hydrochloric acid solution. Why was this necessary?

- A. To ensure the sodium carbonate was not contaminated with hydrochloric acid.
- ✓B. To remove any water.
- C. To heat the sample up.
- D. To keep the sodium carbonate out of the light.

Item Weight: 1.0

Question #: 35

How would the concentration of $\text{Fe}^{+2}(\text{aq})$ ions in equilibrium with FeS be affected if the concentration of $\text{S}^{2-}(\text{aq})$ ions were tripled?

- A. increased by a factor of 6
- B. no change
- C. decreased by a factor 30
- ✓D. decreased by a factor of 3

Item Weight: 1.0

Question #: 36

Which of the following best represents the solubility product expression for the dissociation of strontium phosphate?

A. $K_{\text{sp}} = [\text{Sr}^{+2}]^2[\text{PO}_4^{-3}]^3$

B.

$$K_{\text{sp}} = \frac{[\text{Sr}^{+2}]^3[\text{PO}_4^{-3}]^2}{[\text{Sr}_3(\text{PO}_4)_2]}$$

✓C. $K_{\text{sp}} = [\text{Sr}^{+2}]^3[\text{PO}_4^{-3}]^2$

D. $K_{\text{sp}} = [\text{Sr}^{+2}][\text{PO}_4^{-3}]$

Item Weight: 1.0

Question #: 37

What result would you expect from a pH paper test of a solution of $\text{Ba}(\text{OH})_2$?

- ✓A. pH paper will turn blue
- B. pH paper will turn red
- C. there will be no change in the color of the pH paper
- D. pH paper will turn green

Item Weight: 1.0

Question #: 38

In lab, you conducted a vinegar test by adding 10 to 20 drops of vinegar directly to a solid sample. What were you testing for in this reaction?

- A. The presence of acetic acid.
- B. The formation of an insoluble hydroxide.
- C. The presence of base.
- ✓D. The formation of carbon dioxide.

Item Weight: 1.0

Question #: 39

Which of the following substances would produce an orange flame in the flame test?

- A. boric acid
- ✓B. sodium chloride
- C. sucrose
- D. magnesium sulfate

Item Weight: 1.0

Question #: 40

Various qualitative tests were performed on an unknown sample and the following results were obtained:

1. The unknown was soluble in water.
2. Its aqueous solutions had a pH ranging from 10 to 12.
3. It bubbled in vinegar.

Based on this information, what is the identity of the unknown?

- A. sucrose
- B. sodium hydroxide
- ✓C. sodium carbonate
- D. magnesium sulfate

Item Weight: 1.0