

2011 Ashdown Examination

DIRECTIONS

- Put your name, school, and test number on the bubble sheet, as follows;

NAME Your Name

SUBJECT School

PERIOD _____ DATE _____ Test Number _____

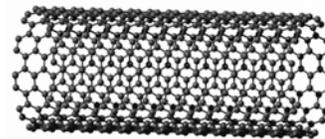
- If you are using a graphing calculator, clear its memory **now**.
- There are 85 questions, and the exam will last 100 minutes.
- When you have selected your answer to each question, blacken the corresponding space on the answer sheet using a soft, #2 pencil. Make a heavy, full mark, but no stray marks. If you decide to change an answer, erase the unwanted mark very carefully.
- There is only one correct answer to each question. Any questions for which more than one response has been blackened **will not be counted**.
- Your score is based solely on the number of questions you answer correctly. **It is to your advantage to answer every question.**
- When you are told to start the exam, you may tear off this sheet and the periodic table sheet below this one.
- After the test is over and the proctors have collected the bubble sheets, you may take this exam home with you.
- Answers will be posted in the registration area after the examination.
- Prize winners and qualifiers will be notified within 3 days or sooner.
- Good luck!

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1. The name of the carbon allotrope shown to the right is:

- A. graphite B. diamond C. bucky ball D. nanotube



2. An example of a solution is:

- A. blood B. milk C. air D. ice

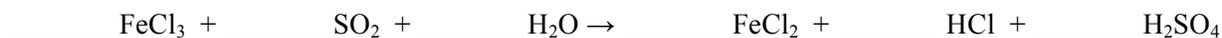
3. The correct name for $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ is:

- A. copper(II) sulfate pentahydrate
B. copper(II) sulfate pentaquate
C. pentaquocopper(II) sulfate
D. pentahydrated copper(II) sulfoxide

4. The element whose name comes from the Greek for light bearing or from the ancient name for the planet Venus when appearing before sunrise is:

- A. sulfur B. gold C. vanadium D. phosphorus

5. Balance this equation with the smallest whole number coefficients and select the answer that is the **sum of the coefficients**.



- A. 7 B. 9 C. 10 D. 12

6. Which of the following will be found on a Material Safety Data Sheet?

- A. Health hazards
B. Precautions for Safe Handling and Use
C. Fire and Explosion Hazard Data
D. All of the above



7. Teachers just love it when students request the proper equipment when doing a laboratory. To impress your teacher, you ask for the item to the right as a:

- A. watch glass.
B. weighing boat
C. Petri dish
D. whatchamacallit.

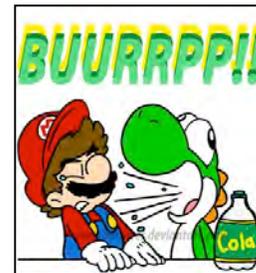


8. Element X that forms a carbonate with the formula XCO_3 that is 9.72% C by mass is: (C= 12.0, O = 16.0)

- A. Mg B. Ca C. Cu D. Ba

9. Which of the following ions will usually produce a precipitate with other ions in aqueous solution?

- A. nitrate B. sulfate C. ammonium D. sulfide



10. Burps are due to stress and swallowed gas. You love burping and decide to study it. You feel a discomfort when the pressure in your diaphragm is 2.05 atm (body temperature is 37°C) and you burp into a balloon which inflates to 6.50 mL at 1.00 atm and 27°C. The volume of the burp in your diaphragm is:

A. 2.31 mL B. 3.28 mL C. 4.35 mL D. 13.8 mL

11. The number of air molecules in the burp in the problem above are:

$$R = 0.0821 \text{ liter} \cdot \text{atm} / \text{mole} \cdot \text{K}, N_0 = 6.022 \times 10^{23}$$

A. 2.64×10^{-4} B. 5.24×10^{-4} C. 1.59×10^{20} D. 3.15×10^{20}

12. The anticancer drug, cis-platin, is used for treatment of solid tumors and is produced by reacting ammonia with potassium tetrachloroplatinate (KTCP) according to the balanced reaction below. The theoretical yield of cis-platin when 5.00 g ammonia and 50.0 g KTCP are used is:

(Formula masses: $\text{K}_2\text{PtCl}_4 = 415.1 \text{ g}$; $\text{NH}_3 = 17.03 \text{ g}$; $\text{Pt}(\text{NH}_3)_2\text{Cl}_2 = 300.1 \text{ g}$)



A. 36.1 g B. 44.1 g C. 69.1 g D. 107 g

13. The numbers below come from scientific measurements. The scientifically calculated answer is:

$$(41 - 32.4) \times (4.867 + 2.295)$$

A. 60 B. 62 C. 61.6 D. 61.5932

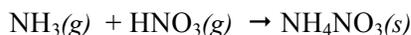
14. Given:

Reaction	$\Delta H(\text{kJ})$
$\text{Ca}(\text{OH})_2(s) + \text{H}_2(g) \rightarrow \text{Ca}(s) + 2 \text{H}_2\text{O}(l)$	414
$2 \text{H}_2\text{O}(l) \rightarrow 2 \text{H}_2(g) + \text{O}_2(g)$	570
$3 \text{CaO}(s) \rightarrow 3 \text{Ca}(s) + 3/2 \text{O}_2(g)$	1905

The ΔH in kJ for: $\text{CaO}(s) + \text{H}_2\text{O}(l) \rightarrow \text{Ca}(\text{OH})_2(s)$ is:

A. -349 B. -64.0 C. 506 D. 1206

15. Ammonia, NH_3 , and nitric acid, HNO_3 , vapors are placed at opposite ends of a 1.00 M linear tube. They diffuse through the tube until they meet each other and form ammonium nitrate shown in the reaction below. ($\text{NH}_3 = 17.0 \text{ g/mole}$, $\text{HNO}_3 = 63.0 \text{ g/mole}$)



How many meters from the ammonia end does the ammonium nitrate form?

A. 0.342 m B. 0.526 m C. 0.658 m D. 0.787 m

16. Excess AgNO_3 solution was added to a solution that contained 1.65 grams of a chloride salt, MCl_3 , of an unknown element M. The AgCl precipitate (143.3 g/mole) after filtering and drying, weighed 2.49 grams. The element M is: ($\text{Cl} = 35.45 \text{ g/mole}$)

A. Fe B. Mo C. Hf D. Re

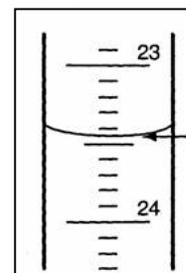
17. Which of the following signs should be prominently displayed in a chemistry laboratory?



- A. I only B. II only C. I, II, and III only D. All should be prominently displayed

18. The volume of the buret to the right is:

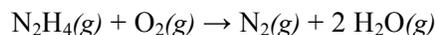
- A. 23.45 mL B. 23.55 mL C. 24.45 mL D. 24.55 mL



19. The pH of a 0.050 M solution of ethylamine, $C_2H_5NH_2$, ($pK_b = 4.6 \times 10^{-4}$) is:

- A. 2.32 B. 2.34 C. 11.64 D. 11.66

20. Combustion of hydrazine, N_2H_4 , shown in the reaction below, is used to power rockets into space. The $\Delta H_{\text{reaction}}$ is:



- A. -1353 kJ B. -571 kJ C. -316 kJ D. -48 kJ

Bond	Bond Enthalpy	Bond	Bond Enthalpy
O-H	463 kJ/mole	N=N	418 kJ/mole
N-H	391 kJ/mole	N≡N	941 kJ/mole
N-N	163 kJ/mole	O ₂	495 kJ/mole

21. AgBr was the light sensitive material used in black and white photography. Photons with a minimum energy of 200 kJ/mole provided the energy need to transfer an electron from Br^- to Ag^+ and thus darken the film. The minimum wavelength of light in nm to darken the film is:

$$(h = 6.628 \times 10^{-34} \text{ J}\cdot\text{s}, c = 3.00 \times 10^8 \text{ m/s}, 1 \text{ nm} = 10^{-9} \text{ m}, N_o = 6.022 \times 10^{23})$$

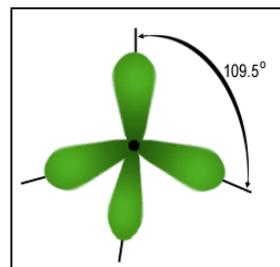
- A. 9.94×10^{-22} nm B. 200 nm C. 599 nm D. 994 nm

22. Virtually the entire world's supply of terephthalic acid, a compound containing only C, H, and O, is used as a precursor to polyethylene terephthalate (PET), a polymer used in beverage, food and other liquid containers. A 2.500 gram sample of terephthalic acid upon combustion with oxygen produced 5.290 g of CO_2 and 0.814 g of H_2O . The molecular weight of terephthalic acid is around 165 ± 5 amu. What is its molecular formula?

- A. $C_8H_6O_4$ B. $C_{10}H_8O_2$ C. $C_8H_8O_4$ D. $C_8H_6O_4$

23. The image to the right shows:

- A. σ_{2p} molecular orbital
 B. 3d atomic orbital
 C. sp^3 hybrid orbital
 D. dsp^3 hybrid orbital



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24. The Ashdown Exam gives you heartburn and you take a teaspoon of Maalox™ antacid for relief. The teaspoonful contains 200 mg of aluminum hydroxide, $\text{Al}(\text{OH})_3$, (78.0 g/mole) and 200 mg of magnesium hydroxide, $\text{Mg}(\text{OH})_2$ (58.3 g/mole). The mL of 0.10 M stomach acid (HCl) that the Maalox™ neutralized is:



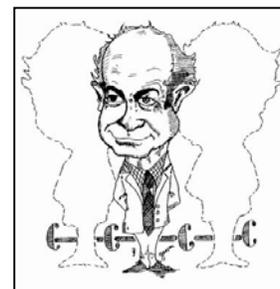
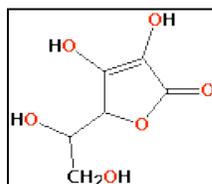
- A. 60 mL B. 110 mL C. 150 mL D. 600 mL

25. An example of the law of definite proportions is:

- A. A sample of chlorine is found to contain three times as much Cl-35 as Cl-37.
 B. Two different compounds formed from carbon and oxygen have the following mass ratios:
 1.33 g O: 1 g C and 2.66 g O: 1 g C.
 C. Two different samples of table salt are found to have the same ratio of sodium to chlorine.
 D. The atomic mass of bromine is found to be 79.90 amu.

26. Considered by many to be the greatest chemist of the 20th century, the double Nobel laureate to the right, strongly associated with the molecule below, is:

- A. Linus Pauling
 B. G. N. Lewis
 C. Glenn Seaborg
 D. James Watson



27. At a pizza party you and two friends decide to drive from Boston to Cancun for a little R&R. You volunteer to drive if everyone chips in for gas. Your friends ask you how much the gas will cost per person for the round trip. You “Google” the driving distance and find it is 2200 miles from Boston to the Texas border and another 1150 miles to Cancun for a total of 3350 miles overall to Cancun. Gasoline in the US costs \$2.80 per gallon. There's 8.20 cents to the peso, and gas costs 8.10 pesos per liter in Mexico. Your car gets 32 miles to the gallon and one gallon equals 3.79 L. How much is the round trip is going to cost in dollars **each** person in gas (\$/person).

- A. \$190 B. \$280 C. \$380 D. \$566

28. In green chemistry the term “atom economy” refers to

- A. How efficiently atoms in the starting materials are incorporated into the product
 B. The percent yield obtained for a given reaction
 C. The cost of starting materials and reagents
 D. The total number of atoms found in the product



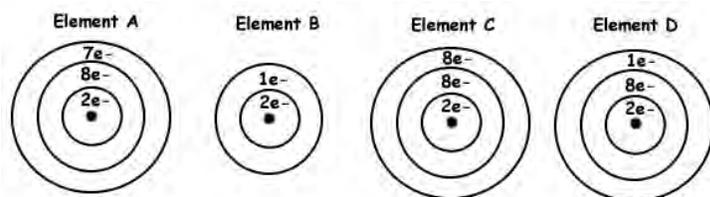
29. You are heating a piece of glass and now want to pick it up. You should

- A. use a rag or paper towels.
 B. pick up the end that looks cooler.
 C. use tongs or hot mitts.
 D. pour cold water on it.



30. The element below which has the lowest first ionization energy is:

- A. Element A B. Element B C. Element C D. Element D



31. The number of structural isomers with the formula $C_4H_{10}O$ are:

- A. 6 B. 7 C. 8 D. more than 8

Use the following proposed reaction mechanism to answer questions 32 and 35. In an aqueous acid solution, the following four step mechanism for the reaction was:

Step 1	$HNO_2 + H^+ \rightleftharpoons H_2O + NO^+$	(equilibrium, K_1)
Step 2	$NH_4^+ \rightleftharpoons NH_3 + H^+$	(equilibrium, K_2)
Step 3	$NO^+ + NH_3 \rightarrow NH_3NO^+$	(slow, k_3)
Step 4	$NH_3NO^+ \rightarrow H_2O + H^+ + N_2$	(fast, k_4)

32. The overall reaction is:

- A. $2 HNO_2 + 6 H^+ \rightarrow 4 H_2O + N_2$
 B. $NH_4^+ + HNO_2 \rightarrow N_2 + 2 H_2O + H^+$
 C. $NH_4^+ + 3 HNO_2 + 3 H^+ \rightarrow 2 N_2 + 6 H_2O$
 D. $2 NH_4^+ + 2 HNO_2 + 2 H^+ \rightarrow 4 N_2 + 6 H_2O$

33. The intermediates are:

- A. NH_3NO^+ B. NO^+ , NH_3NO^+ C. NO^+ , NH_3 , NH_3NO^+ D. H^+ , NO^+ , NH_3NO^+

34. The overall rate law from the mechanism is:

- A. $k [HNO_2] [NH_4^+]$
 B. $k [HNO_2]^2 [NH_4^+]$
 C. $k [HNO_2] [NH_4^+]^2$
 D. $k [HNO_2]^2$

35. The rate constant k above is:

- A. $k_3 K_1 K_2 / [H_2O]$
 B. $k_3 K_1 K_2 [H_2O]$
 C. $k_4 [H_2O] / k_3 K_1 K_2$
 D. k_3

36. The half-life of a nuclide that loses 38.0% of its mass in 387 hours is:

- A. 277 hours B. 455 hours C. 561 hours D. 639 hours

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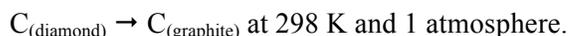
37. The electrolysis of 0.100 L of 0.785 M AgNO_3 aqueous solution is carried out with a current of 1.75 A for 25.0 min. The molarity of the AgNO_3 solution after the electrolysis is: (1 Faraday = 96500 coulombs / mole)
- A. 0.0272 B. 0.272 C. 0.513 M D. 0.758 M

For questions 38 and 39, use the following: $K_{\text{sp}}(\text{SrSO}_4) = 7.5 \times 10^{-7}$ and $K_{\text{sp}}(\text{SrF}_2) = 8.0 \times 10^{-10}$. An aqueous solution of $\text{Sr}(\text{NO}_3)_2$ is slowly added with stirring to 1.0 liter of solution containing 0.020 mole F^- and 0.10 mole SO_4^{2-} . Assume that the added $\text{Sr}(\text{NO}_3)_2$ does not affect the total volume.

38. The concentration of Sr^{2+} when the first precipitate begins to form is:
- A. 4.0×10^{-8} M B. 2.0×10^{-6} M C. 7.5×10^{-6} M D. 1.9×10^{-3} M
39. As more $\text{Sr}(\text{NO}_3)_2$ is added to the mixture in a second precipitate begins to form. At that stage, what percent of the anion of the first precipitate remains in solution?
- A. 0.53% B. 38% C. 43% D. 50%

For questions 40-42, use the table to the right for graphite and diamond at 298 K.

Are diamonds “forever?” Are they a “girl’s best friend?” Will diamonds spontaneously convert to graphite? Consider the reaction:



Diamond	Graphite
$S^\circ = 2.43 \text{ J/mole K}$	$S^\circ = 5.79 \text{ J/mole K}$
$\Delta H_f^\circ = 1.88 \text{ kJ/mole}$	$\Delta H_f^\circ = 0 \text{ kJ/mole}$

40. From the data, ΔG° for the reaction at 298 K and 1 atm is:
- A. -0.879 kJ B. -2.88 kJ C. -58.9 kJ D. -1003 kJ
41. For this reaction, at what temperature will it become nonspontaneous?
- A. It is always spontaneous B. 559 K C. 1880 K D. 11300 K
42. For the reaction, the equilibrium constant K_{eq} at 298 K is: Use $R = 8.314 \text{ J / K} \cdot \text{mole}$
- A. 0.31 B. 0.46 C. 1.00 D. 3.20

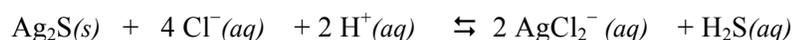
For questions 43-45, use the following:

A student dissolved 1.356 grams of ascorbic acid (vitamin C), a monoprotic acid, in 50.00 mL of distilled water and titrated it with a 0.220-molar NaOH using a pH meter similar to the setup to the right. The equivalence point was reached when 35.00 mL of the base had been added. :



43. The molecular mass in grams/mole of ascorbic acid is:
- A. 52.5 B. 123 C. 176 D. 193
44. When 20.00 milliliters of NaOH had been added, the pH of the solution was 4.23. K_a for ascorbic acid is:
- A. 3.70×10^{-5} B. 4.41×10^{-5} C. 7.85×10^{-5} D. 9.36×10^{-5}
45. The pH of the solution at the equivalence point is:
- A. 5.46 B. 8.53 C. 8.72 D. 11.42

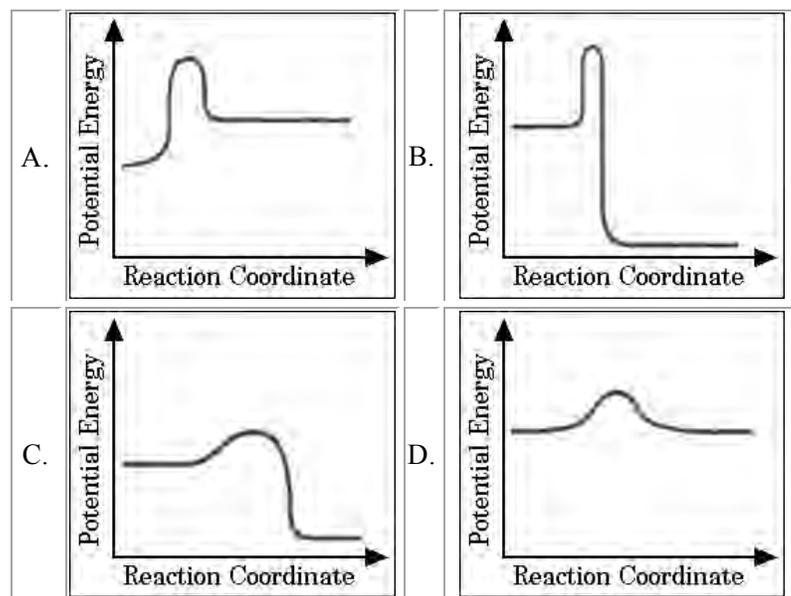
46. Using the values listed in the table, find the equilibrium constant for:



- A. 6×10^{-72} B. 6×10^{-67} C. 6×10^{-22} D. 6×10^{-15}

K_{sp} for Ag_2S	6×10^{-51}
K_{a1} for H_2S	1×10^{-7}
K_{a2} for H_2S	1×10^{-19}
K_f for AgCl_2^-	1×10^5

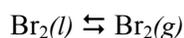
47. Which of the following is a graph that describes the pathway of reaction that is endothermic and has high activation energy?



48. Which of the following statements is **always TRUE** about the phase diagram of any one-component system?

- A. The slope of the curve representing equilibrium between the vapor and liquid phases is positive.
 B. The slope of the curve representing equilibrium between the liquid and solid phases is negative.
 C. The slope of the curve representing equilibrium between the solid and gas phases is negative.
 D. The temperature at the triple point is greater than the normal freezing point.

Use the following information for questions 49-53. For the vaporization of Br_2 at 25°C the equilibrium constant, K_p , for the reaction below is 0.281 atm. $R = 8.314 \text{ J/mole}\cdot\text{K}$



49. ΔG° for this reaction at 298 K is:

- A. -16.2 kJ B. 3.14 kJ C. 2.48 kJ D. 16.2 kJ

50. It takes 190 J to vaporize 1.00 gram of $\text{Br}_2(l)$ ($\text{Br}_2 = 159.8 \text{ grams/mole}$) at 25°C and 1.00 atmosphere pressure. The value of ΔH°_{298} is:

- A. 190 J B. 1.25 kJ C. 30.4 kJ D. 198.4 kJ

51. ΔS°_{298} for this reaction in $\text{J/mole}\cdot\text{K}$ is:

- A. 91.3 B. 112 C. -1088 D. 1340



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52. Assuming that ΔH° and ΔS° remains constant as the temperature is changed., the normal boiling point of bromine in $^\circ\text{C}$ is:

- A. -2.84 B. 13.7 C. 59.4 D. 75.2

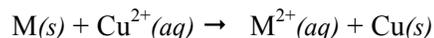
53. The vapor pressure of bromine in torr at 25°C is:

- A. 3.56×10^{-3} atm B. 0.172 atm C. 0.281 atm D. 1.00 atm

54. The electron geometry, molecular geometry, and polarity of IO_2F_2^- is:

	Electron Geometry	Molecular geometry	Polarity
A	tetrahedral	tetrahedral	nonpolar
B	trigonal bipyramidal	see-saw	polar
C	trigonal bipyramidal	trigonal pyramidal	polar
D	octahedral	square planar	nonpolar

For questions 55-57, use the reaction below. This cell has $E^\circ = 0.740$ volt at 25°C .



55. Given the standard reduction potential: $\text{Cu}^{2+}(aq) + 2e^- \rightarrow \text{Cu}(s)$ $E^\circ = +0.340$ V, the standard reduction potential for the half-reaction of $\text{M}^{2+}(aq) + 2e^- \rightarrow \text{M}(s)$ is:

- A. -0.400 V B. 0.400 V C. 0.800 V D. 1.080 V

56. The above cell is constructed so that all substances are in their standard states. Equal solution volumes are used. The cell is then discharged. The cell potential, E , when $[\text{Cu}^{2+}]$ has dropped to 0.20 molar is:

$$E = E^\circ - 0.0592/n \log Q$$

- A. 0.712 V B. 0.717 V C. 0.768 V D. 0.796 V

57. The ratio $[\text{M}^{2+}]_{\text{aq}} / [\text{Cu}^{2+}]_{\text{aq}}$ when the cell reaction above reaches equilibrium is:

- A. 1.1 B. 7.2×10^{10} C. 3.2×10^{12} D. 1.0×10^{25}

58. Which of the following statements is **TRUE**?

- A. A strong acid is composed of a proton and an anion that have a very strong attraction for one another.
 B. A weak base is composed of a cation and an anion with a very weak attraction between them.
 C. A strong acid has a strong conjugate base.
 D. The conjugate base of a very weak acid is stronger than the conjugate base of a strong acid.

59. The radius of a metal atom is 125 pm and its atomic mass is 77.22 amu. The density of the metal is 10.66

g/cm^3 . Which of the cubic crystalline structures best fits the metals size and density? $1 \text{ cm} = 10^{10} \text{ pm}$, = cell length, $N_0 = 6.022 \times 10^{23}$

- A. face centered cubic (= $2\sqrt{2}r$) B. body centered cubic(= $4r/\sqrt{3}$) C. simple cubic (= $2r$) D. Rubik's cubic

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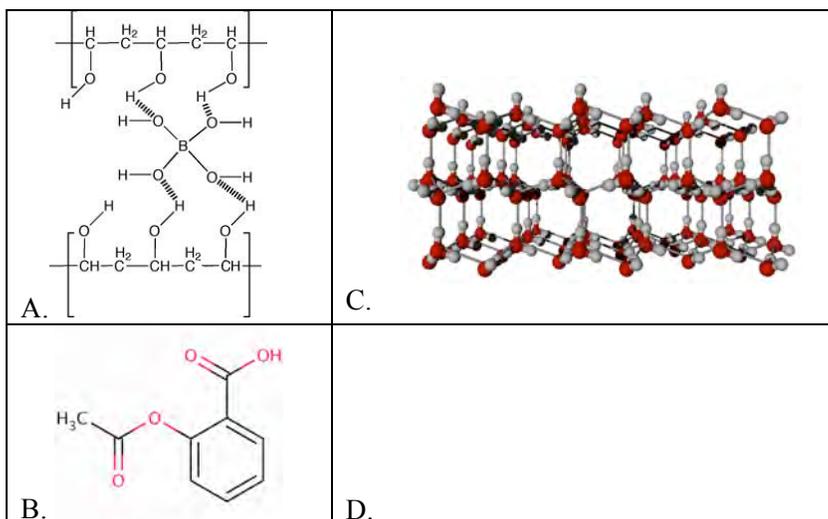
Use the following figures to answer questions 60-63.

60. Required "to walk on water."

61. It's slimy!

62. Its chemistry grade is always an "A."

63. Taken after this exam?

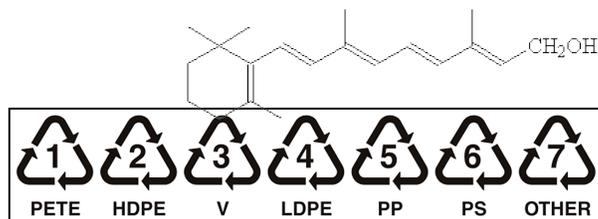


64. A buffer solution of formic acid, $pK_a = 3.74$, and sodium formate has a $pH = 3.70$. After the addition of 0.015 moles of $[H^+]$, the pH decreases by 0.12. The initial molarity of the formic acid is:

- A. 0.084 M B. 0.105 M C. 0.115 M D. 0.210 M

65. The symbols to the right represent categories for

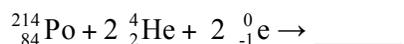
- A. hazardous materials
 B. nuclear wastes.
 C. famous rappers.
 D. plastic recycling



66. You have to make a graph for your lab report. The procedure **best** to use is:

- A. If you draw your figures by hand, do not use a ruler. If you had wanted to draw a sterile, clinical looking graph, you would have used a computer!
 B. Make the data points as small as possible. You know you have succeeded when your data points are indistinguishable from fly droppings. In this case it also helps to **not** connect the data points. After all, that's why they are called data points, not data lines
 C. Always demonstrate your artistic talent and produce graphs unique in format, expression and content. By all means, avoid boring, square graph formats. For example, make one axis much longer than the other.
 D. None of the above.

67. Identify the missing particle in the following nuclear reaction:



- A. ${}_{86}^{222}\text{Rn}$
 B. ${}_{88}^{218}\text{Ra}$
 C. ${}_{86}^{218}\text{Rn}$
 D. ${}_{84}^{222}\text{Po}$

68. At 50°C, substance A has a vapor pressure of 500 torr and substance B has a vapor pressure of 100 torr. A solution of A and B was mixed and the vapor is found to have equal moles of A and B. What was the mole fraction of A in the original solution?
- A. 0.17 B. 0.20 C. 0.25 D. 0.75
69. The molar mass of glucose is 180 g/mole and the molar mass of sucrose is 342 g/mole. Assuming ideal behavior, a plot of the freezing point vs. molal concentration of sucrose would be:
- A. Linear with slope equal to that of a similar plot for glucose.
 B. Linear with slope equal to twice that of a similar plot for glucose.
 C. Linear with slope equal to one half that of a similar plot for glucose.
 D. Nonlinear with the rate of curvature twice that for a similar plot for glucose.
70. Using Lewis structures and formal charge, which of the following ions is most stable?
- OCN⁻ ONC⁻ NOC⁻
- A. OCN⁻ B. ONC⁻ C. NOC⁻ D. All equally stable
71. Which procedure is recommended for reading the level of an aqueous solution in a buret or graduated cylinder?
- A. Keep eye level with the bottom of the meniscus and record that reading.
 B. Keep eye level with the top of the meniscus and record that reading.
 C. Look down at the meniscus at an angle to obtain the average reading.
 D. Read both the top and bottom of the meniscus and average those readings.
72. Place the following in order of **increasing** NO bond length: NO₂⁻ NO₃⁻ NO
- A. NO < NO₂⁻ < NO₃⁻
 B. NO₃⁻ < NO₂⁻ < NO
 C. NO₃⁻ < NO = NO₂⁻
 D. NO < NO₃⁻ = NO₂⁻
73. A solution of 1.40 g of hemoglobin in 50.0 mL of water has an osmotic pressure of 7.60 torr at 25°C. What is the molecular weight of hemoglobin? R = 0.0821 liters atm / mole K, 760 torr = 1 atm
- A. 2.87 x 10² B. 3.43 x 10³ C. 5.75 x 10³ D. 6.85 x 10⁴
74. Which of the following statements is **TRUE** about NO₂⁻?
- A. The nitrite ion contains one N-O single bond and one N=O double bond.
 B. The nitrite ion contains two N-O bonds that are equivalent to 1½ bond.
 C. The nitrite ion contains two N=O double bonds.
 D. The nitrite ion contains two N-O single bonds.
75. A concentration of 10-100 ppb by mass of Ag is an effective disinfectant in swimming pools. However the concentration of silver adverse these levels can cause adverse effects. One way to maintain the appropriate concentration is to use a slightly soluble salt. From the table to the right, which salt should be use to provide the appropriate Ag⁺ concentration. (Ag = 107.9 g/mole)
- A. AgCl B. AgBr C. AgI D. Ag₂S

Salt	K _{sp}
AgCl	2 x 10 ⁻¹⁰
AgBr	6 x 10 ⁻¹³
AgI	8 x 10 ⁻¹⁷
Ag ₂ S	6 x 10 ⁻⁵¹

76. Classify the following salts when placed in aqueous solution, are acidic, neutral or basic.



	Acidic	Basic	Neutral
A.	2	2	1
B.	1	3	1
C.	1	2	2
D.	3	2	0

You have four unlabeled bottles, each containing small pieces of one of the following metals.

- Magnesium
- Sodium
- Copper
- Aluminum

The following reagents are used for identifying the metals.

- Pure water
- 1.0-molar HCl
- Concentrated HNO_3

77. The metal that reacts with the pure water is:

- A. Magnesium B. Sodium C. Copper D. Aluminum



78. The only metal that reacts **only** with concentrated HNO_3 solution.

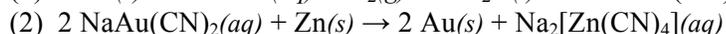
- A. Magnesium B. Sodium C. Copper D. Aluminum



79. A 0.10 M aqueous solution of the sodium salt, NaX , of a weak acid, HX , has a pH of 8.70. The K_a of a weak acid is:

- A. 2.0×10^{-9} B. 6.3×10^{-9} C. 5.0×10^{-6} D. 4.0×10^{-5}

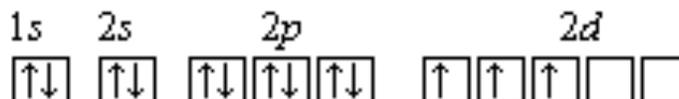
80. Unlike most metals, gold is found pure in nature. In the TV show, "Yukon Gold," gold nuggets and gold dust were searched for in streambeds where denser gold was easily separated from sand and gravel. However, larger deposits of gold are found in veins of rock and can be separated chemically in a two-step process:



If a 1.0×10^3 kilograms of rock is 0.019% gold by mass, how many grams of Zn are needed to react to extract the gold from the rock? Assume that reactions (1) and (2) are 100% efficient. $\text{Au} = 197$, $\text{Zn} = 65.4$

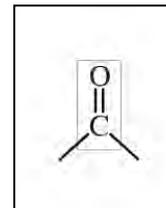
- A. 12.6 B. 31.5 C. 126 D. 1230

81. Which principle or rule(s) does this configuration violate?

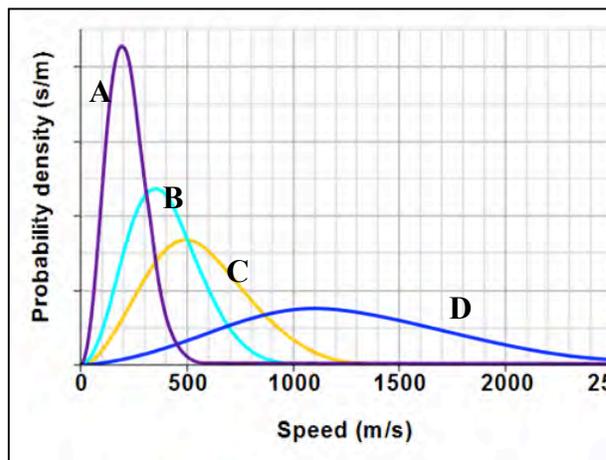


- A. Hund's rule
 B. Pauli exclusion principle
 C. Aufbau principle
 D. Rules for acceptable quantum numbers and atomic orbitals

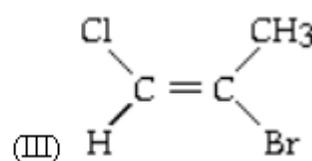
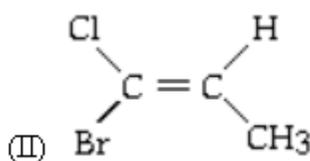
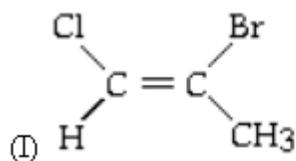
82. Many compounds in organic chemistry contain the same functional group from which different organic molecules are made. The C=O group pictured to the right is a typical example. The name of this functional group is:



- A. Amide group
 B. Carbonyl group
 C. Terpene group
 D. Ester group
83. The graph shows four noble gases, He, Ne, Ar, and Xe at the same temperature. Which one is He?
- A. A B. B. C. C D. D



84. Which of the following molecules are geometric isomers of each other?



- A. No geometric isomers B. I and II C. II and III D. I and III

84. Cold-blooded animals decrease their body temperature in cold weather to match their environment. The activation energy of a certain enzyme-catalyzed reaction in a cold-blooded animal is 65 kJ. By what percentage is the rate of this reaction decreased if the body temperature of the animal drops from 30°C to 15°C?
 $R = 8.314 \text{ J / mole} \cdot \text{K}$

- A. 26% B. 30% C. 74% D. 77%

