

Form B

Chemistry 101-005

Exam # 2

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Edmond F. Bowden

Name:

Redacted

(please print)

Instructions - Read Carefully

- All answers should be indicated on the OPSCAN form that is provided to you. Fill in one circle per question using a #2½ or softer pencil.
- Calculator use is prohibited.
- There are 40 questions. Each question is worth 2.5 points.
- Constants and electronegativities are provided on Page 2.

1A																8A				
1 H 1.008	2A															2 He 4.003				
3 Li 6.941	4 Be 9.012											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18			
11 Na 22.99	12 Mg 24.31	3B	4B	5B	6B	7B	8B			1B	2B	13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95			
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.88	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.39	31 Ga 69.72	32 Ge 72.61	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80			
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (98)	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3			
55 Cs 132.9	56 Ba 137.3	57 La 138.9	72 Hf 178.5	73 Ta 181.0	74 W 183.8	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	84 Po (209)	85 At (210)	86 Rn (222)			
87 Fr (223)	88 Ra 226.0	89 Ac 227.0	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (264)	108 Hs (265)	109 Mt (268)	110 s (269)											

58 Ce 140.1	59 Pr 140.9	60 Nd 144.2	61 Pm (145)	62 Sm 150.4	63 Eu 152.0	64 Gd 157.3	65 Tb 158.9	66 Dy 162.5	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173.0	71 Lu 175.0
90 Th 232.0	91 Pa 231.0	92 U 238.0	93 Np 237.0	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)

Form B

1. The symbol for gold is:

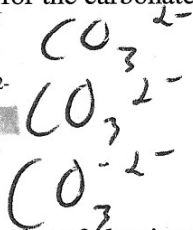
- A. Eu
- B. Gd
- C. Ag
- D. Hg
- E. Au

E

2. The formula for the carbonate ion is:

- A. CO_2^{2-}
- B. CO_2^{1-}
- C. $\text{C}_2\text{O}_3^{2-}$
- D. CO_3^{2-}
- E. CO_3^{1-}

D



3. How many moles of aluminum ions and nitrate ions are present in 10 moles of aluminum nitrate? (Give answer in the order: aluminum, nitrate).

- A. 20, 10
- B. 10, 30
- C. 30, 10
- D. 10, 10
- E. 10, 20

B

4. What is the proper name of the chemical substance VCl_4 ?

- A. vanadium(IV) chloride
- B. tetrachlorovanadium
- C. tetrachlorovanadate
- D. vanadium chloride
- E. vanadium tetrachloride

A

5. Which one of the following ions has the electron configuration $[\text{Kr}] 4d^{10}$?

- A. Sn^{2+}
- B. Sn^{4+}
- C. Ge^{4+}
- D. Se^{2+}
- E. Sr^{2+}

B

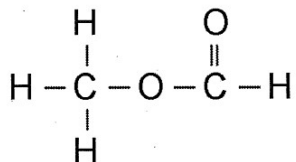
6. What are the oxidation states of K and P in the substance K_3PO_4 ?

- A. +3, +3
- B. -1, +3
- C. -1, +5
- D. +1, +3
- E. +1, +5

E

Form B

11. Determine the oxidation states of the two carbon atoms in the following molecule. Give your answer in the order: left most carbon, right most carbon. Lone pairs are not shown.



B

~~A~~

- A. -4, +4
- B. -2, +2
- C. 0, 0
- D. +2, -2
- E. +4, -4

12. Identify the proper name of the molecule with the formula N_4S_4 :

D

- A. nitrogen sulfide
- B. nitrogen tetrasulfide
- C. nitrogen(IV) sulfide
- D. tetranitrogen tetrasulfide
- E. tetranitrogen sulfide

non metal

13. Rank the following covalent bonds containing phosphorus in order of increasing polarity: P-Br, P-F, P-O, P-S.

C

~~A~~

- A. P-Br < P-F < P-O < P-S
- B. P-S < P-Br < P-F < P-O
- C. P-S < P-Br < P-O < P-F
- D. P-F < P-O < P-Br < P-S
- E. P-F < P-O < P-S < P-Br

F O S Br

14. Which statement regarding these same four bonds (P-Br, P-F, P-O, P-S) is true?

A

~~B~~

- A. phosphorus bears the positive end of the bond dipole in all four bonds
- B. phosphorus bears the negative end of the bond dipole in all four bonds
- C. phosphorus bears the positive end of the bond dipole in one of the bonds and the negative end in the other three
- D. phosphorus bears the negative end of the bond dipole in one of the bonds and the positive end in the other three
- E. phosphorus bears the positive end of the bond dipole in two of the bonds and the negative end in the other two

15. Covalent bond energies (kJ/mol) fall approximately in the following range:

D

- A. 0.1 - 1
- B. 1 - 10
- C. 10 - 100
- D. 100 - 1000
- E. 1000 - 10,000

Form B

21. Consider the molecule having the formula HCP (where C is the central atom). How many lone pairs are on the P atom, and what is the carbon-phosphorus (CP) bond order. Give your answer in the order: # of lone pairs on P, then CP bond order.

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

C

1
4
5

10

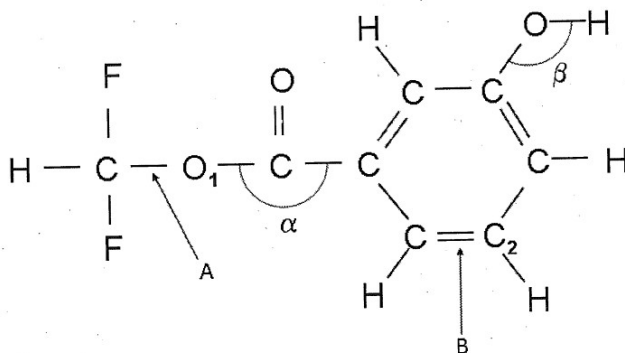


22. According to Valence Bond theory, orbitals can be involved in three possible functions: 1) formation of σ -bonds, 2) formation of π -bonds, and 3) holding a lone pair of electrons. Which of these three functions can be performed by hybridized orbitals (sp , sp^2 , sp^3):

- A. Only σ -bonds and lone pairs
 B. Only π -bonds and lone pairs
 C. σ -bonds, π -bonds, and lone pairs
 D. Only σ -bonds and π -bonds
 E. Only σ -bonds

A

23. Consider the following molecule (all atoms obey the octet rule although lone pairs are not shown):



What are the bond orders for A & B, and which one is the shortest?

- A. A: 1 B: 2 B is the shortest
 B. A: 1 B: 2 A is the shortest
 C. A: 1 B: 1.5 B is the shortest
 D. A: 1 B: 1.5 A is the shortest

C

24. For the structure in Question 23, give the hybridization of the two atoms designated O_1 and C_2 :

- A. O_1 : sp^3 C_2 : sp^3
 B. O_1 : sp^3 C_2 : sp^2
 C. O_1 : sp C_2 : sp^3
 D. O_1 : sp C_2 : sp^2
 E. O_1 : sp C_2 : sp

B

Form B

29. Of the following molecules, which ones are polar?

N₂O SO₃ HCN OF₂ CCl₂F₂

- D
- A. HCN OF₂ CCl₂F₂
 - B. N₂O SO₃ HCN OF₂
 - C. N₂O HCN OF₂
 - D. N₂O HCN OF₂ CCl₂F₂
 - E. HCN OF₂

30. Of the following molecules, which ones are predicted to have important hydrogen bonding interactions between like molecules?

CH₃OH CF₃H ~~HCl~~ ~~H₂Te~~ ~~CH₃NH₂~~

- A
- A. CH₃OH CH₃NH₂
 - B. ~~CF₃H~~ H₂Te CH₃NH₂
 - C. ~~CH₃OH~~ ~~CF₃H~~ H₂Te
 - D. CH₃OH CF₃H CH₃NH₂
 - E. CH₃NH₂

31. Consider that you have two different molecules, A and B, both at P = 1 atm and T = 25°C. Under these conditions, Molecule A exists as a gas and Molecule B exists as a liquid. Which of the following is a correct statement? Use |PE| to designate the magnitude (absolute value) of the energy of interaction between like molecules.

- E
- A. A has a greater thermal energy than B, and $|PE|_A > |PE|_B$.
 - B. A has a greater thermal energy than B, and $|PE|_B > |PE|_A$.
 - C. B has a greater thermal energy than A, and $|PE|_A > |PE|_B$.
 - D. Thermal energies of A and B are approximately the same, and $|PE|_A > |PE|_B$.
 - E. Thermal energies of A and B are approximately the same, and $|PE|_B > |PE|_A$.

32. At room temperature, thermal energy has approximately the following value in kJ/mol:

- C
- A. 0.0025
 - B. 0.25
 - C. 2.5
 - D. 250
 - E. 2.5×10^6

33. Four of the following five statements regarding thermal energy are incorrect. Identify the one true statement?

- D
- A. thermal energy is a form of potential energy
 - B. thermal energy in a solid is primarily due to translational movements of atoms
 - C. thermal energy in a gas is primarily due to rotational movements of atoms
 - D. condensed phases are favored when the magnitude of the thermal energy is less than the magnitude of the potential energy of interaction between particles
 - E. thermal energy is proportional to temperature in degrees Celsius (°C)

Form B

38. To what temperature in Kelvins must a 2.0 liter container containing 4.4 g of neon be heated to obtain a pressure of 1.55 atm?

- D X
- A. $[(4.4)(0.0821)] / [(1.55)(2.0)]$
 - B. $[(4.4 / 20.18)(0.0821)] / [(1.55)(2.0)]$
 - C. $[(1.55)(2.0)] / [(4.4)(0.0821)]$
 - D. $[(1.55)(2.0)] / [(4.4 / 20.18)(0.0821)]$

39. Determine the number of moles of fluorine atoms that are present in 45.6 g of calcium fluoride?

- A X
- A. $(45.6)(2) / 78$
 - B. $(45.6)(78) / 2$
 - C. $(45.6)(2)(78)$
 - D. $45.6 / [(78)(2)]$

40. How many moles of phosphate ions are present in 10 moles of magnesium phosphate?

- B X
- A. 10
 - B. 20
 - C. 30
 - D. 40
 - E. 50

$$\begin{array}{r} 40 \\ 14 \\ \hline 54 \end{array}$$