

UNIVERSITY OF VICTORIA

CHEMISTRY 101

Properties of Materials

Midterm Test 2

November 2, 2018

6-7 pm

ECS 123, BWC B150, BWC A104 or DTB A120

VERSION A

Display your student ID card on your desk.

Do not begin until instructed by the invigilator.

Print and code your last name, first name, and your student ID number on the blue bubble sheet.

This test has 22 multiple choice questions on 6 pages.

A Data Sheet is provided.

The Sharp EL510, Sharp EL510 RNB (also EL510 RN), and Sharp EL510 RTB (also EL510 RT) are the only approved calculators for this test.

Select the best response for each question and record your answer on the blue bubble sheet.

Hand in the blue bubble sheet at the end of the test.

1. Using the titration reaction equation below, what volume of 0.05823M NaOH is required to reach the endpoint with 0.6131 g of $\text{KHC}_8\text{H}_4\text{O}_4$ (MW = 204.23g. mol^{-1}), using phenolphthalein (MW = 318.32g. mol^{-1}) as an indicator?



- A) 3.002×10^{-3} L
 B) 0.3002 L
 C) 20.23 mL
 D) 51.55 mL
 E) 5.155×10^{-2} mL

0.003002

0.003002 moles $\text{KHC}_8\text{H}_4\text{O}_4$

= 0.05155 L

2. Which of the following orbitals does not adopt a degenerate set in a free atom?

- A) 3p B) 4d C) 5f D) 1s E) 2p

3. Which of the elements listed below contains a valence electron with the set of quantum numbers $\ell = 1, m_\ell = 1, m_s = +1/2$?

- A) As (arsenic) #33
 B) Cs (cesium) #55
 C) Sc (scandium) #21
 D) Tb (terbium) #65
 E) Ag (silver) #47



4. Which of the elements listed below is a member of the s block?

- A) Si (silicon) #14
 B) Se (selenium) #34
 C) Sn (tin) #50
 D) S (sulfur) #16
 E) Sr (strontium) #38

5. Which of the following pairs of atoms and ions are isoelectronic?

- A) As^{3-} and Ge^{2-}
B) Se^{2-} and Br^-
C) Na^+ and Mg
D) Ca^{2+} and K
E) Cr^{2+} and Mn^+



what is isoelectronic
though?
haha I fucked
up lol

6. Which of the following atoms has the largest atomic radius?

- A) thallium (Tl) B) boron (B) C) gallium (Ga) D) indium (In) E) aluminum (Al)

7. Which of the following atoms has the highest electronegativity?

- A) Se B) As C) Br D) Ge E) Ga

8. Which of the following atoms or ions has the highest ionization energy?

- A) Na B) Al C) Si D) P^{3-} E) Mg^{2+}

9. Which of the following ions is expected to have the largest radius in the gas phase?

- A) Sb^{3-} B) In^+ C) Br^- D) Te^{2-} E) Sn^{2+}

10. Which of the following electron configurations is not correct?

- A) $1s^2, 2s^2, 2p^3$
- B) $1s^2, 2s^2, 2p^6, 3s^1$
- C) $1s^2, 2s^2, 2p^6, 3s^2$
- D) $1s^2, 2s^2, 2p^3, 3s^1$
- E) $1s^2, 2s^2, 2p^6, 3s^2, 3p^2$

Handwritten notes for question 10:
 $1s$
 ~~$2s$~~ ~~$2p$~~
 ~~$3s$~~ ~~$3p$~~ ~~$3d$~~
 $4s$

11. Which of the elements listed below has the electron configuration $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2$?

- A) Ti (titanium) #22
- B) Mg (magnesium) #12
- C) Zr (zirconium) #40
- D) Ge (germanium) #32
- E) Ca (calcium) #20

12. Which of the following species has the electron configuration $1s^2 2s^2 2p^6 3s^2 3p^6 3d^3$?

- A) Sc
- B) V^{2+}
- C) V
- D) Ga
- E) Mn^{2+}

13. How many unpaired electrons are there in Fe^{2+} ?

- A) 3
- B) 2
- C) 4
- D) 1
- E) 0

Handwritten notes for question 13:
 Fe $8 e^-$

14. Which of the following atoms or ions is paramagnetic?

A) P

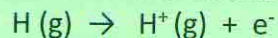
B) Ge^{2+}

C) Ba

D) Sc^{3+}

E) Al^{3+}

15. Which of the following terms describes the energy exchange in the chemical equation below?



A) Electrostatic repulsion

B) Lattice energy

C) Electron affinity

D) Ionization energy

E) Electrostatic attraction

16. Which of the following ions does not have a full shell of valence electrons?

A) B^{3+}

B) F^-

C) O^{2-}

D) N^{2-}

E) Mg^{2+}

17. How many bond pairs (lines) are drawn in the best Lewis structure for the chlorate anion $[\text{ClO}_3]^-$?

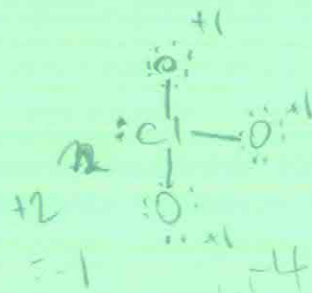
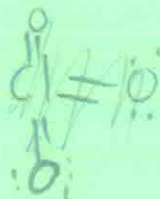
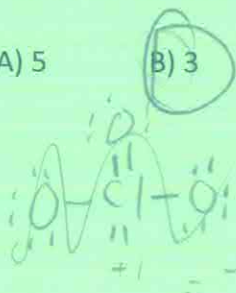
A) 5

B) 3

C) 6

D) 4

E) 7



18. How many lone pairs are drawn in the best Lewis structure for the nitrite anion $[\text{NO}_2]^-$?

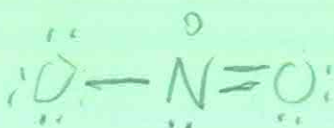
A) 4

B) 3

C) 6

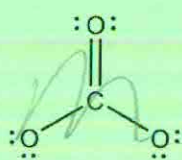
D) 5

E) 7

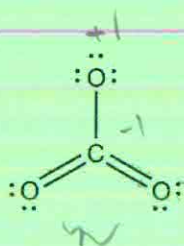


$$\begin{array}{r} 6 \\ + 6 \cdot 2 \\ \hline 18 \end{array}$$

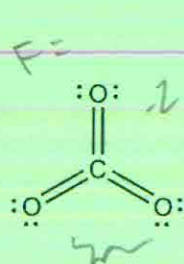
19. Which of the drawings below is the best Lewis structure for carbonate anion $[\text{CO}_3]^{2-}$?



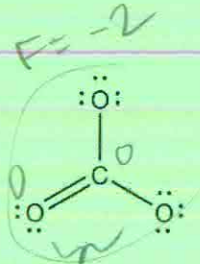
A)



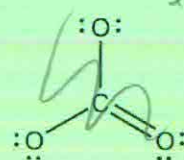
B)



C)



D)



E)

$$\begin{array}{r} 18 \\ + 6 \\ \hline 24 \end{array}$$

20. Which of the following molecules is planar?

A) CF_4

B) SF_4

C) PF_3

D) IF_5

E) XeF_4

21. What is the most likely molecular shape for $[\text{SO}_3]^{2-}$?

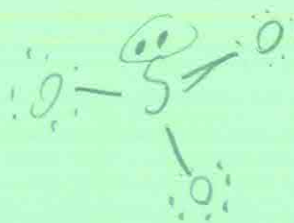
A) trigonal pyramid

B) trigonal planar

C) tetrahedral

D) linear

E) trigonal bipyramid



$$\begin{array}{r} 6e^- \\ + 2e^- \\ \hline 8e^- \\ + 18e^- \\ \hline 26e^- \end{array}$$

22. What is the most likely F-B-F bond angle in $[\text{BF}_4]^-$?

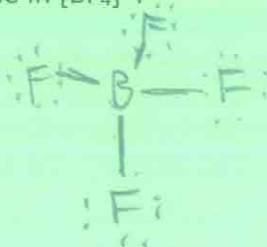
A) approx. 90°

B) approx. 109°

C) approx. 120°

D) approx. 90° and 120°

E) approx. 180°



$$\begin{array}{r} 7 \\ \times 4 \\ \hline 28 \\ + 4 \\ \hline 32 \end{array} \quad B=3$$

END