

**Version
B**

**UNIVERSITY OF VICTORIA
CHEMISTRY 101
Midterm Test 2
November 22, 2013
5-6 pm (60 minutes)**

**Version
B**

DISPLAY YOUR STUDENT ID CARD ON THE TOP OF YOUR DESK NOW

Answer all multiple choice questions on the bubble sheet provided. Use a soft pencil. The scanner does not read ink. Complete the identification portion of the bubble sheet according to the example shown. (The student's name in the example is Bab Cabba.)

Version A = 0
Version B = 1

For Section A01

IDENTIFICATION COURSE/SECTION SPECIAL DATE

A B C D E F G H J K L M N O P Q MO. DAY YR.

V0 0 2 3 4 5 6 7 1 A

Section A02
Section A03

Leave the last five columns blank.

NAME (LAST, FIRST, MIDDLE INITIAL)

CABBA BAB

Hand in only the bubble sheet at the end of the test period (60 minutes).

A DATA sheet is included, unstapled, inside the cover page of this test.

This test has 5 pages (not including the DATA sheet). Count the pages before you begin.

The basic Sharp EL510 calculator or the Sharp EL-510 RNB are the only ones approved for use in Chemistry 101.

DO NOT BEGIN UNTIL TOLD TO DO SO BY THE INVIGILATOR

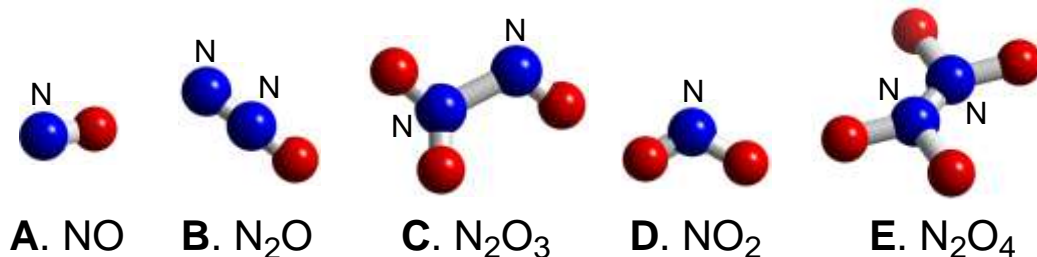
This test consists entirely of multiple choice questions and is worth 50 marks. There are two marks per question. The answers for the 25 questions must be coded on the optical sense form (bubble sheet) using a SOFT PENCIL. The scanner does not read ink of any colour. Select the BEST response for each question below.

- In which of the following molecules or ions does the presence of non-bonding electron pairs produce an effect on the molecular shape? (Assume all are in the gas phase.)
(i) SiH_4 (ii) PF_3 (iii) HCN (iv) O_3
A. (ii) only B. (ii) & (iv) C. (iv) only D. (i) & (ii) E. (ii), (iii), & (iv)
- How many **non-bonding** electrons are there in the azide ion, $[\text{N}_3]^-$?
A. 8 B. 6 C. 4 D. 10 E. 16
- What is the hybridization state of the central atom in the azide ion, $[\text{N}_3]^-$? That is, what orbital hybridization do we attribute to the central nitrogen atom in this ion?
A. sp^3d^2 B. sp^3d C. sp^3 D. sp^2 E. sp
- Which of the following anions has **ONLY ONE** non-bonded pair of electrons (lone pair) on the **chlorine**?
A. ClO_4^- B. ClO_2^- C. ClO_3^-
D. ClO^- E. Cl^-
- Pi (π) bonds are formed through the overlap of what type of orbitals?
A. s B. p C. sp D. sp^2 E. sp^3
- Tungsten, W, has the highest melting point of all the metals in the periodic table. Why?
A. Tungsten has half-filled s and d bands.
B. Tungsten has the highest effective nuclear charge of all the metals.
C. Tungsten has the highest electronegativity of all the metals.
D. Tungsten has the highest atomic weight.
E. Tungsten has the highest conductivity of all the metals.
- The structure shown is a representation of which molecule?

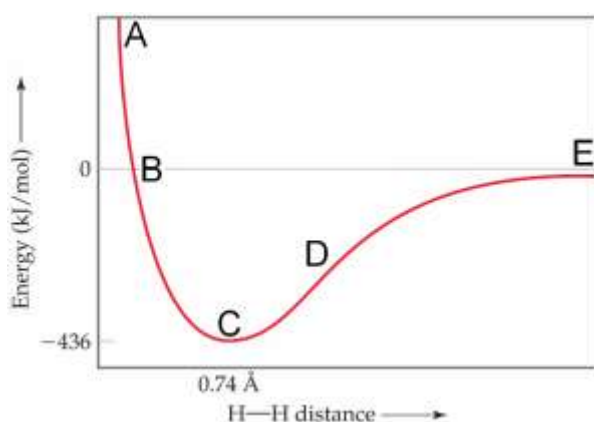


- A. GaBr_3 B. PCl_3 C. IF_3 D. AsH_3 E. BF_3

8. Which of the following oxides of nitrogen (A, B, C, D or E) is NON-polar? (ANS E)

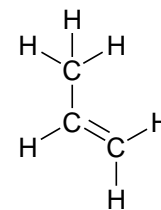


9. A plot of change in potential energy versus distance for two H atoms combining to form H₂ is shown below. At what point (A, B, C, D or E) is the two-atom system the most stable? (ANS C)



10. How many sp^2 hybrid orbitals are there in a molecule of propene, C₃H₆ (structural formula shown)?

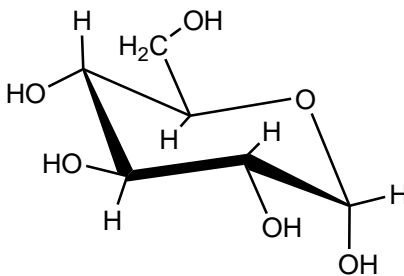
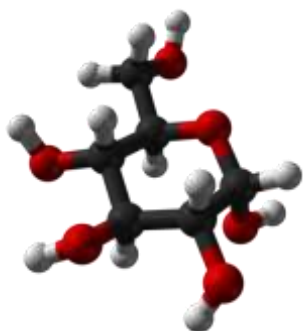
- A. 2 B. 6 C. 4 D. 8 E. 16



11. How many sp^3 orbitals are there in a molecule of propene, C₃H₆ (structural formula shown above)?

- A. 2 B. 6 C. 4 D. 8 E. 16

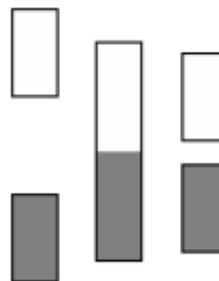
12. What intermolecular force is most important in explaining why the simple sugar glucose, $C_6H_{12}O_6$, is soluble in water?



- A. hydrogen bonding
 - B. ion-dipole
 - C. dipole-dipole
 - D. ionic bonding
 - E. London dispersion forces
13. What intermolecular force is most responsible for molecular iodine, I_2 , being a solid at room temperature?
- A. ionic bonding
 - B. ion-dipole
 - C. dipole-dipole
 - D. hydrogen bonding
 - E. London dispersion forces
14. What intermolecular force is most responsible for sodium chloride, $NaCl$, being soluble in water?
- A. ionic bonding
 - B. dipole-dipole
 - C. ion-dipole
 - D. hydrogen bonding
 - E. London dispersion forces
15. Supramolecular chemistry involves the adjusting of weak intermolecular forces to control assemblies of molecules. Which of the following type of interaction is not important in supramolecular chemistry?
- A. hydrogen bonding
 - B. ion-dipole
 - C. dipole-dipole
 - D. ionic bonding
 - E. London dispersion force
16. What type of phase is represented in the picture at the right?
- A. Liquid
 - B. Nematic liquid crystal
 - C. Smectic liquid crystal
 - D. Cholesteric liquid crystal
 - E. Supercritical fluid



17. What gives ionic liquids their low melting point?
- Low molecular weight
 - No ionic bonding
 - High lattice energy
 - Large ions and shape mismatch between them
 - Lack of hydrogen bonding
18. Considering likely intermolecular forces, which of the following should have the highest boiling point?
- $\text{CH}_3\text{-O-CH}_3$
 - $\text{CH}_3\text{CH}_2\text{SH}$
 - $\text{CH}_3\text{CH}_2\text{CH}_3$
 - $\text{CH}_3\text{CH}_2\text{OH}$
 - $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$
19. The following three diagrams represent the orbital energy bands for three different kinds of solid materials. These are, from left to right:



- conductor, semiconductor, insulator
- semiconductor, conductor, insulator
- insulator, semiconductor, conductor
- semiconductor, insulator, conductor
- insulator, conductor, semiconductor

Consider the following five substances and then answer questions 20 to 22.

- BaF_2
- OCS
- HCCH
- Cl_2
- C_2Cl_4

20. Which substance has only ONE pi bond? **ANS E**
21. Which substance exhibits IONIC bonding? **ANS A**
22. Which substance consists of polar molecules? **ANS B**

23. What is the molecular geometry of IF_5 ?

- seesaw (irregular tetrahedron)
- octahedron
- square pyramid
- square planar
- trigonal bipyramid

24. Propyne, $\text{H-C}\equiv\text{C-CH}_3$, has how many sigma (σ) and how many pi (π) bonds?

- 5 σ , 3 π
- 5 σ , 1 π
- 3 σ , 2 π
- 6 σ , 2 π
- 8 σ , 0 π

25. Of the molecules CO_2 , NH_4^+ , and CO_3^{2-} , which has/have delocalized pi (π) bonding?

- CO_2 and NH_4^+
- CO_3^{2-} only
- CO_2 and CO_3^{2-}
- CO_2 only
- NH_4^+ and CO_3^{2-}

END