Yellow

I. MULTIPLE CHOICES (30 points): Write the letter that corresponds to the best answer in each of the following questions. Transfer your answers on the Scantron form. ***Answers on the form are final.***

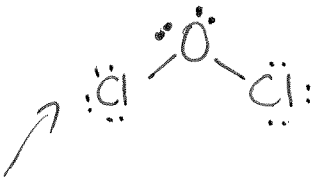
H 2.20

Electronegativity Values for Some Elements

Li 0.98	Be 1.57	B 2.04	C 2.55	N 3.04	O 3.44	F 3.98
Na 0.90	Mg 1.31	Al 1.61	Si 1.90	P 2.19	S 2.58	Cl 3.16
K 0.82	Ca 1.00	Ga 1.81	Ge 2.01	As 2.18	Se 2.55	Br 2.96

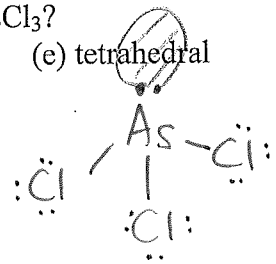
Image available at f.u-tokyo.ac.jp

6 + 14 = 20 e (10 pr.)



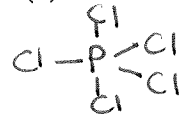
a 1. Draw the Lewis structure of OCl_2. What is the molecular geometry of OCl_2?
(a) bent (b) Trigonal pyramidal (c) linear (d) trigonal planar (e) tetrahedral

b 2. Draw the Lewis structure of $AsCl_3$. What is the molecular geometry of $AsCl_3$?
(a) bent (b) Trigonal pyramidal (c) linear (d) trigonal planar (e) tetrahedral



a 3. Which of the following molecules is/are *polar*?
(a) HCN (b) PCl_5 (c) CS_2 (d) a and b (e) a and c

polar



sym. so nonpolar

:S=C=S: nonpolar (sym.)

d 4. Which of the molecules below has at least one *polar bond*?
(a) AsH_3 (b) CH_4 (c) OCl_2 (d) PF_3

$\Delta EN = 0.02$ Hydrocarbon Nonpolar

$\Delta EN < 0.4$ nop non-polar

$\Delta EN = 1.79$

d 5. Which of the molecules below is *polar*? See # 4.
(a) AsH_3 (b) CH_4 (c) OCl_2 (d) PF_3

C 6. Choose the molecule below that contains at least one polar bond, but is *nonpolar*.
X (a) SiH_4 X (b) H_2O ✓ (c) CCl_4 X (d) HCl

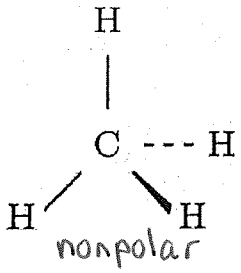
$\Delta EN = 0.35$ no polar bond

$\Delta EN > 0.4$ polar bond unsym. so polar

$\Delta EN > 0.4$ but sym. so nonpolar

polar bond, unsym. so polar

d 7. Which of the following molecules is/are *nonpolar*?

(a) 
nonpolar

(b) :Ö=C=Ö: nonpolar (symmetrical)

(c) PF_3 (See question 5 above) polar

(d) Both a and b

(e) Both b and c

d 8. Arrange NH_3, CH_4 and PH_3 in order of increasing intermolecular forces of attraction. ↗ low to high

(a) $PH_3 < CH_4 < NH_3$ (b) $NH_3 < PH_3 < CH_4$ (d) $CH_4 < PH_3 < NH_3$

CH_4 + PH_3 are nonpolar, but PH_3 is heavier, so higher bp than CH_4 ⇐ NH_3 is polar and forms H-bonding so ~~highest bp~~ stronger IMF

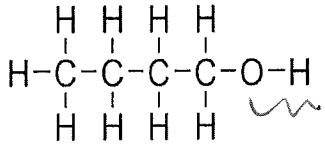
a 9. Which of the following molecules will exhibit hydrogen-bonding in the liquid state? stronger IMF

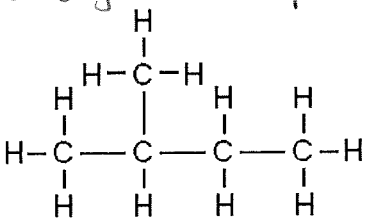
(a) CH_3NH_2 ✓ N-H bond (b) C_2H_4 (c) CH_4 (d) PH_3

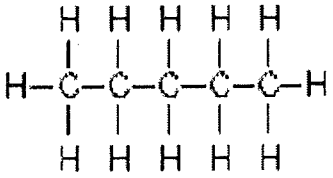
d 10. Which of the following liquids will boil at the highest temperature?

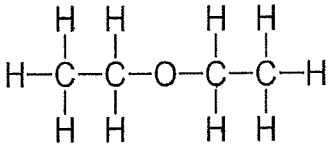
(a) SbH_3 (b) AsH_3 (c) PH_3 (d) NH_3 ↳ N-H bond so H-bonding

a 11. Which of the following compounds will have the lowest vapor pressure? = strongest IMF, so look for H-bonding

(a) 
✓

(b) 
X

(c) 
X

(d) 
X No O-H bond

$1.5\ mol \times \frac{6.022 \times 10^{23}\ atoms}{1\ mol\ Al}$

b 12. How many atoms are there in 1.5 moles of magnesium? (Note: Avogadro's number equals 6.022×10^{23} particles)

(a) 2.49×10^{-25} (b) 9.03×10^{23} (c) 4.01×10^{23} (d) 2.49×10^{-24} (e) 9.03×10^{25}

b 13. Which of the following samples contain the largest number of atoms? 1 mol = 6.022×10^{23} atoms

(a) 0.50 mol O_2 ↳ = 1 mol O atoms (b) 1.10 mol Al (c) 1.08 g B ↳ 0.1 mol (d) 1.20 g C ↳ 0.1 mol

b 14. What is the molar mass of OCl_2?

(a) 51.45 g/mol (b) 86.91 g/mol (c) 44.07 g/mol (d) 98.13 g/mol