Unit 2 Review for Midterm

① Substance A is an ionic solid. It has a relatively high melting point and conducts electricity in liquid state, not solid (ionic cmpds conduct electricity when ions can move freely, like in liq)

Substance B is a metallic solid. It has high melting point and conducts electricity as solid

C is molecular covalent bond substance - low melting point, doesn't conduct electricity

D is network covalent solid - very high melting point, does not conduct electricity

② a) A - atoms are too close together + are repelling (nuclei are repelling)

B - less repulsion; balance between attraction + repulsion

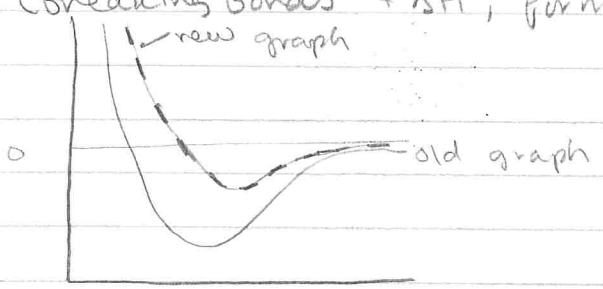
C - maximum attraction between atoms; this is where the bond will end up; indicates average bond length

D - atoms are too far apart to have strong attractive force

b) C

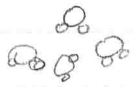
c) same energy as point C but will be (+) (breaking bonds + ΔH; forming bonds - ΔH)

d)



farther to right b/c atoms are bigger

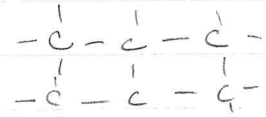
less energy b/c it will take less energy to break bonds - larger atoms don't have as strong attraction b/c they're bigger

③ a) 

atoms are covalently bonded, molec. are separate

b) 

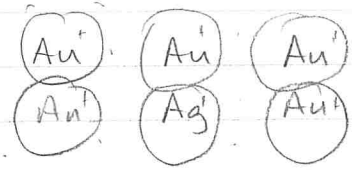
3D crystal structure of repeating ⊕ + ⊖ to maximize attraction + minimize repulsion

c) 

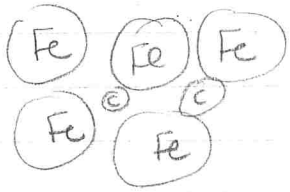
carbon atoms covalently bonded - network - covalent solid

d) 

copper ions surrounded by sea of e^- (metallic bonding)

e) 

similar size atoms, Ag substitutes for Au (and they're metals)

f) 

little atoms fit in between bigger Fe atoms

④ a) Na-F Mg-F C-F O-F F-F

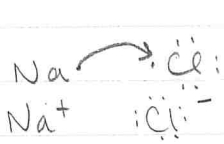
F is more electronegative / both same

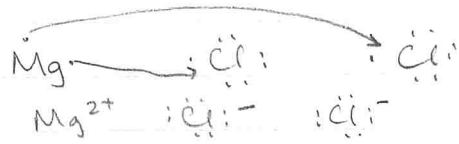
b) Na-F + Mg-F C-F, O-F, F-F

more ionic more covalent

c) C-F O-F polar F-F nonpolar

d) most polar C-F least polar F-F

⑤ a) 

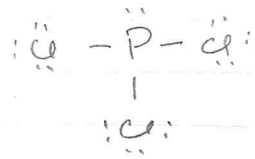


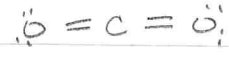
b) metals give up e^- - the outermost e^- are far away from ⊕ nucleus + shielded by other core e^-, doesn't take much energy to remove, low IE

c) lattice energy - energy required to separate 1 mol solid crystal into gaseous ions.

d) $MgCl_2$ - Mg^{2+} has stronger attraction force b/c of +2 charge

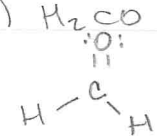
(6) a) PCl_3 b) O_2 c) CO_2



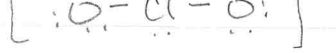


EDG:	tetrahedral	EDG linear	linear
MG:	pyramidal	MG linear	linear
angle	<109.5	—	180°

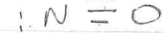
d) H_2CO



e) Chlorite ClO_2^-

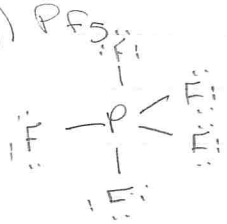


d) NO^+

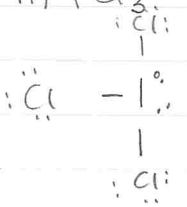


EDG:	trig planar	tetrahedral	linear
MG:	trig planar	bent	linear
angle:	120°	>109.5	—

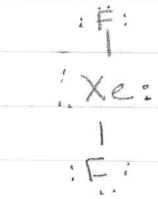
g) PF_5



h) ICl_3



i) XeF_2



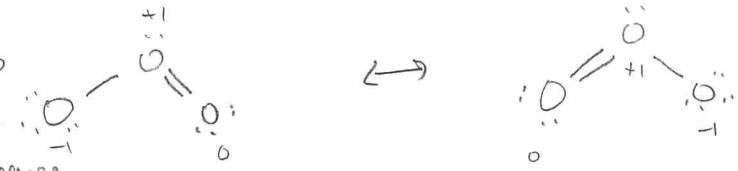
EDG	trig bipyramidal	trig bipyramidal	trig bipyr.
MG	trig bipyramidal	T-shaped	linear
angle	90°, 120°	90°	180°

(7) a) NCS^-

formal charge

most dominant - least amount of formal charges, ⊖ formal charge on electronegative atom

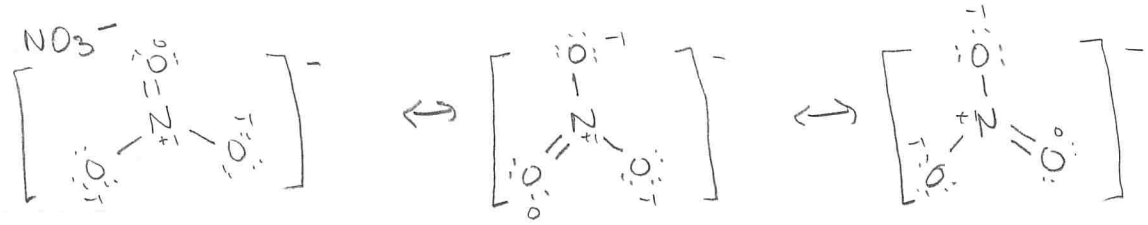
(7) b) O_3



formal charge

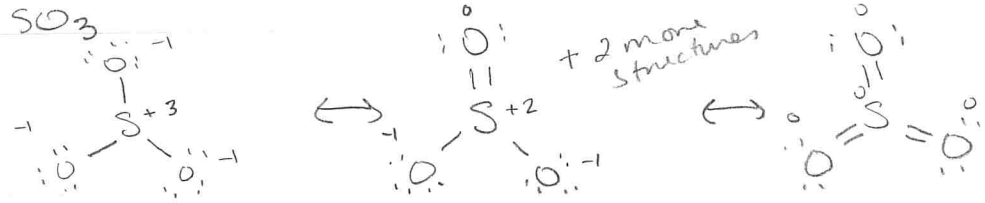
neither is dominant over the other

c) NO_3^-



none of resonance structures are dominant

d) SO_3

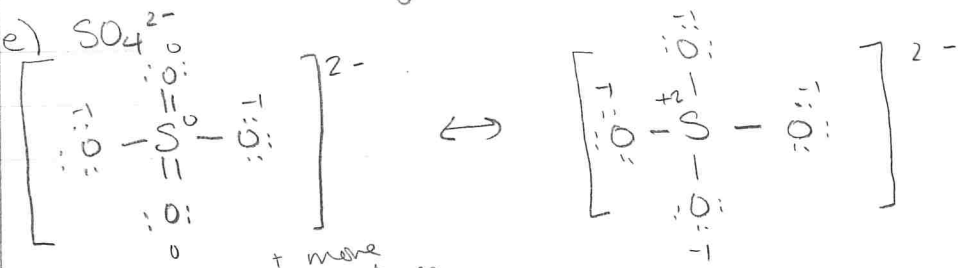


+ 2 more structures

most dominant

least amt of formal charges

e) SO_4^{2-}

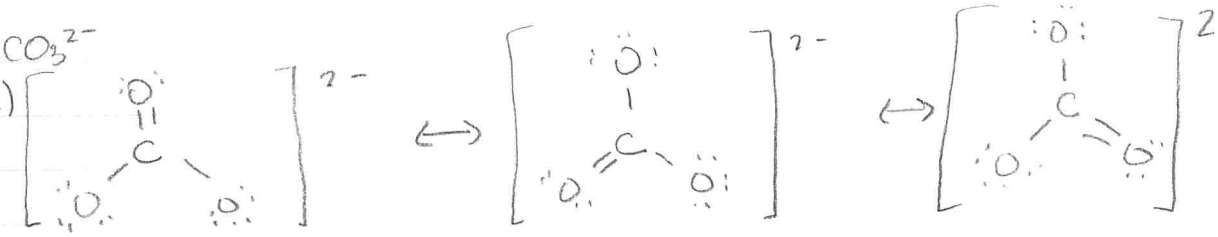


+ more structures

more dominant, fewer formal charges

(8) CO_3^{2-}

a)

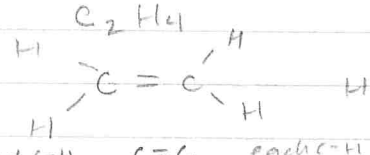


all bonds are same length + same strength

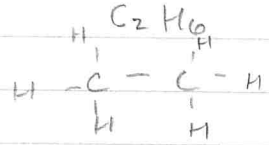
all resonance structures contribute equally to overall structure, so each C–O bond is like a 1.33 bond.

(9) a) C_2H_2

C_2H_4



C_2H_6



b) H–C: 1σ; C≡C: 1σ, 2π; C–H: 1σ

each C–H: 1σ; C=C: 1σ, 1π; each C–H: 1σ

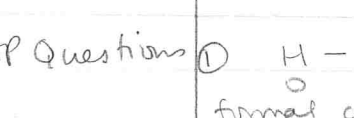
all 1σ

c) C≡C shortest, strongest

C–C longest, weakest

d) C≡C sp C=C sp^2 C–C sp^3

AP Questions

① 

formal charges

a) the negative formal charge is on the more electronegative atom (O) in the left structure. on the right structure the negative formal charge is on C, which is not the more electronegative atom

b)

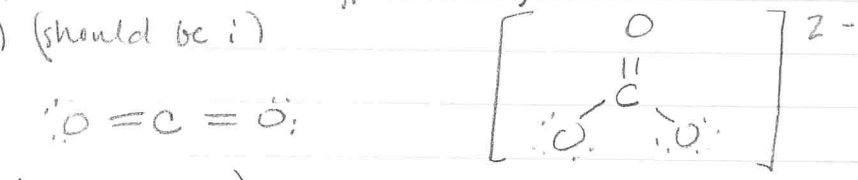
breaking bonds		forming bonds	
H–C	413	H–N	391
C≡N	891	N=C	615
N–O	201	C=O	745
	1505 – endo		1751 – exo

ΔH = bonds breaking − bonds forming

= 1505 − 1751 = −246 kJ/mol

(2) a) Um... ok (typo here!)

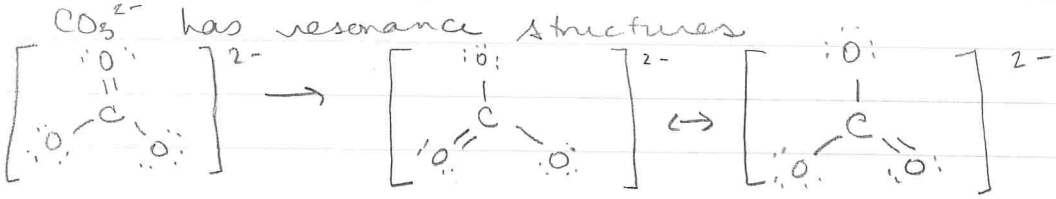
b) (should be i)



c) (should be ii)

each carbon-oxygen bond in CO_2 is a double bond

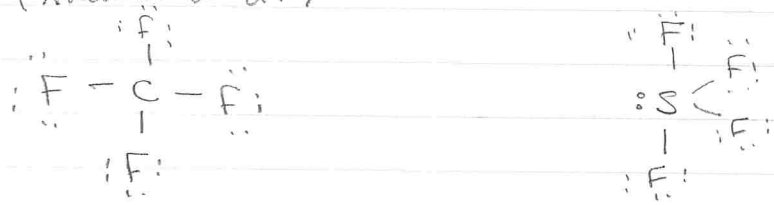
CO_3^{2-} has resonance structures



the actual structure of CO_3^{2-} is a combination of all resonance structures so each carbon-oxygen bond is between a single & double

d) oops again

e) (should be di)



f) (should be di)

CF_4 is a tetrahedral molecule that is symmetrical the electron density is distributed evenly around the molecule.

SF_4 is see saw shaped & not symmetrical.

e^- can be pulled to one side of molecule, making it polar

③ a) i)

propanone

ii) 120°

b) i) propane vs propanone

19.0 kJ/mol 32.0 kJ/mol

Propanone is a polar molecule w/ dipole-dipole interactions between molecules

Propane is non polar w/ London Dispersion forces. LDF

Dipole-dipole interactions are stronger than LDF + take more energy to overcome + vaporize

ii) propanone + 1-propanol

32.0 kJ/mol 47.3 kJ/mol

Propanone has dipole-dipole interactions while 1-propanol has stronger hydrogen bonding between molecules, requiring more heat energy to vaporize

c) isomer - same formula, different structure

d) i) sp

ii) 6 total σ bonds (one for each C-H bond C-C, and one for C≡C)

2 π bonds (2 for C≡C)

(4) a) C_2H_2 $H-C\equiv C-H$

b) Ethyne - triple bonds are shorter than single bonds

c) i) trigonal planar

ii) tetrahedral

d) False. Energy is used to overcome attractive forces between molecules. The covalent bonds within the molecules are unaffected when boiling

e) CH_3CH_3 (or C_2H_2) is nonpolar. The electron cloud is distributed evenly throughout molecule

f) Ethanol can form hydrogen bonds w/ water molecules. Ethanethiol cannot form H-bonds w/ water