

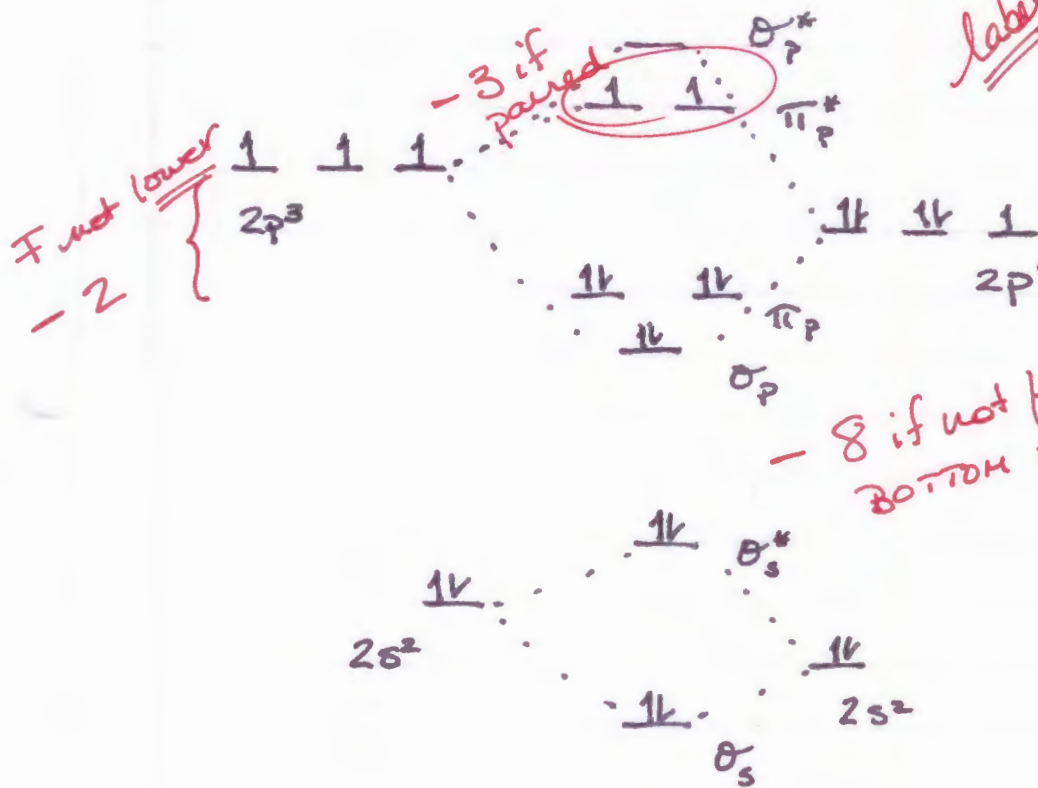
CHEM 1101 C MT2 · W 2015

1.

O^+ -2 if e^- removed from F

OF⁺
(12e⁻)
not 12e⁻? -4 F

Labels: -3 if *, unshared not correct
-1 per σ vs π error max -2
∴ -5 if missing



F not lower -2

-3 if paired

-8 if not filled BOTTOM TO TOP

b) $\frac{1}{2}$ Bond order: $(8-4)/2 = 2$ (double)

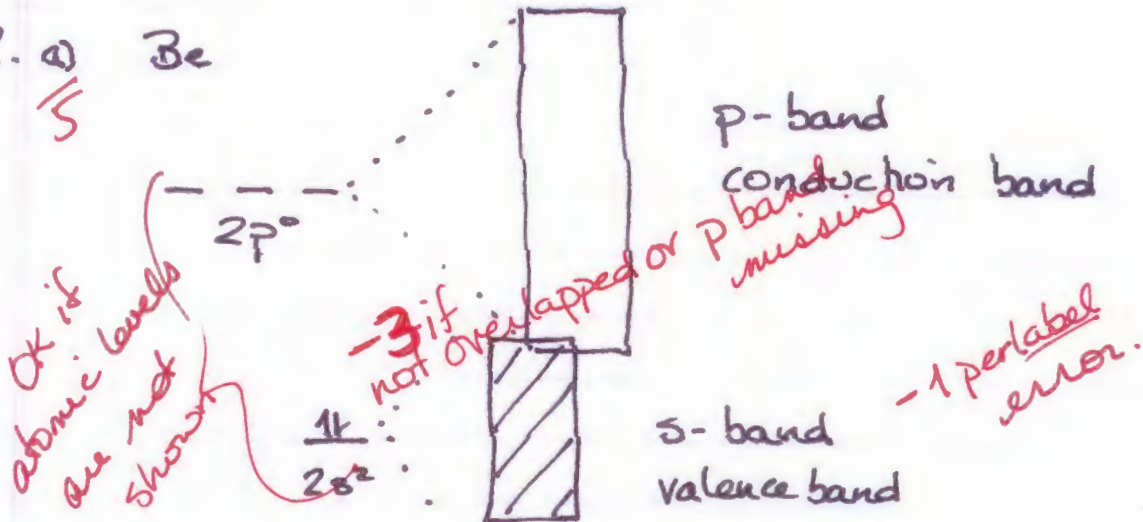
c) $\frac{1}{3}$ PARAMAGNETIC ^{① word} - there are two unpaired ^{② explanation} electrons

d) $\frac{1}{3}$ Weaker ^{① choice} - the extra e^- would be in an antibonding orbital (∴ a lower Bond Order) ^{② explanation (either wording ok)}

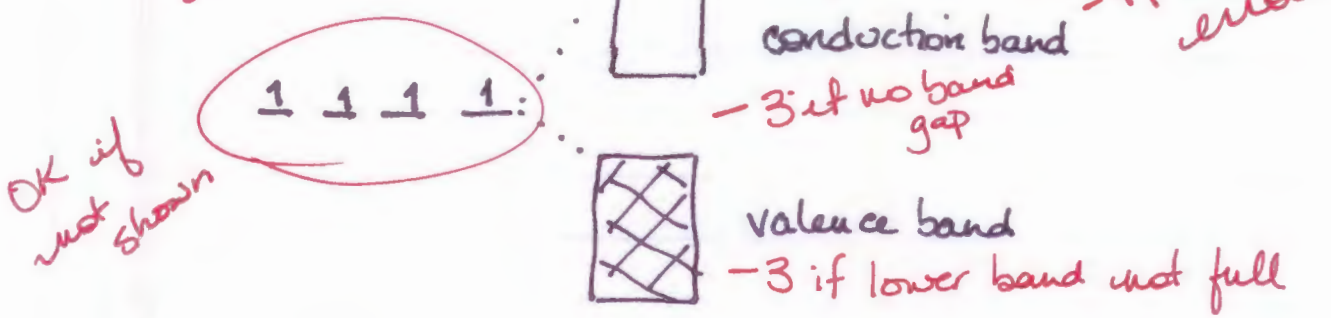
CHEM 1101 C

MT2 - W 2015

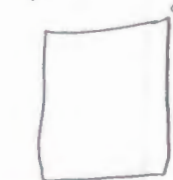
2. a) 5 Be



b) 5 Si



if

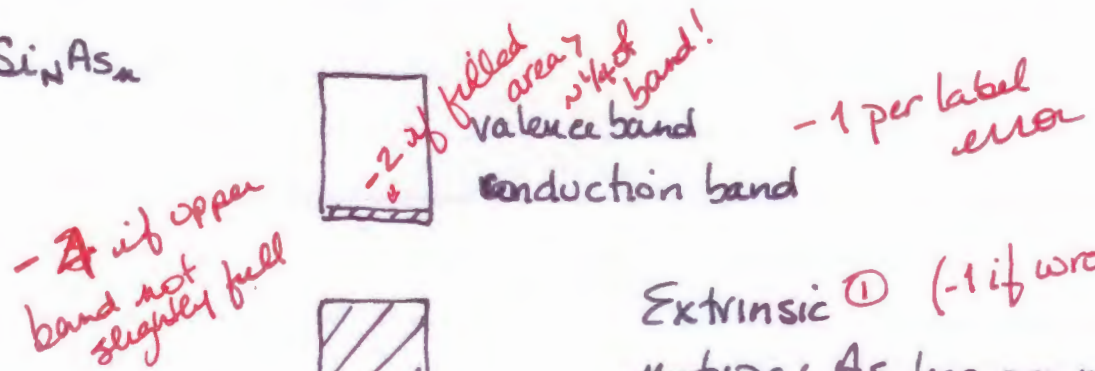


3/10



p-type (fewer valence e⁻)

c) 10 Si_NAs_N



Extrinsic 1 (-1 if wrong)
n-type: As has one more valence e⁻ than Si.

-1 if wrong 1
1 = 1 if not explained.

Does not need to be shown separately as long as its covered in the equations

-2 if not converted properly to grams 3.

3. $F_2(g) : 37.996 \text{ g/mol} \therefore \frac{12.0 \times 10^3 \text{ g}}{37.996 \text{ g/mol}} = 315.822 \text{ moles}$
 -1 if 18.998 g/mol used (631.645 mol)
 -3 if not \div by molar mass

Wrong (F)
 $P_{ideal} = 152 \text{ atm}$
 (only deduct the 1 mark here)
 5

$P(100.0 \text{ L}) = (315.822 \text{ mol})(0.08206 \text{ L}\cdot\text{atm}/\text{K}\cdot\text{mol})(294 \text{ K})$
 -2 wrong R -3 if not in K

$P = [76.194252] = 76.2 \text{ atm}$
 -1 calc. error -1 sig figs (only ONE for entire Q.3)
 -1 rounding -2 units missing

Wrong F
 $P_{real} = 140 \text{ atm}$
 (do NOT deduct any more marks)
 5

b) $[P + \frac{(1.16)(315.822)^2}{(100.0)^2}] [(100.0) - (315.822)(0.0290)] = 7619.4252 \text{ L}\cdot\text{atm}$

$[P + 11.5702] [90.84116] = 7619.4252$

$P + 11.5702 = 83.8763$

$P = 72.3 \text{ atm}$

c) Size: Ideal assumes molecules have \emptyset size. 2

Intermolecular Forces / Elastic collisions: Ideal assumes that I.H.F.'s are \emptyset / collisions are perfectly elastic.
 either wording is fine 2

* Since $P_{ideal} > P_{real}$; Intermolecular forces are significant / collisions are not perfectly elastic
 either wording 3/3 if correct
 (1/3 Comparison if that's all that's correct. This is one of these three!)

CHEM 1101 C MT2- W2015

4. a) P₁ : 1 atm

P₂ : 37°C + 273 = 310K

$\Delta H_{vap} = 43.4 \times 10^3 \text{ J/mol}$

T₁ : 100°C = 373K

T₂ :

R = 8.314 J/K·mol (both J or both kJ)

- 8 if any other set of P/T reference used.

- 3 if not matched

- 8 if pairs mixed (its ok to use P₂ = 1 atm & P₁/T₁ for other set)

$\ln\left(\frac{P_2}{1 \text{ atm}}\right) = \frac{43.4 \times 10^3 \text{ J/mol}}{8.314 \text{ J/K}\cdot\text{mol}} \left(\frac{1}{373\text{K}} - \frac{1}{310\text{K}}\right)$
= (5220.11 K) (-0.000544841 K⁻¹)

$\ln(P_2/1 \text{ atm}) = -2.84413$

- 2 calc error
- 2 units missing (wrong)

P₂ = 0.05818 atm = 0.06 atm

- 1 if sig figs aren't 1 or 2. (accept 0.058 atm)

b) P V = n R T

(0.05818 atm)(0.15L) = n (0.08206 L·atm / K·mol)(310K)

- 2 wrong R

- 2 wrong T
- 2 if not in K

0.00343089 mol = n (H₂O)

MH_{H₂O} = 18.015 g/mol

- 2 wrong Molar Mass

∴ mass = [0.0061807] = 0.006 g

- 2 if not converted to mass (accept 0.0062 g)

or consistent w. part a sig figs

no sig fig deduction on this one.

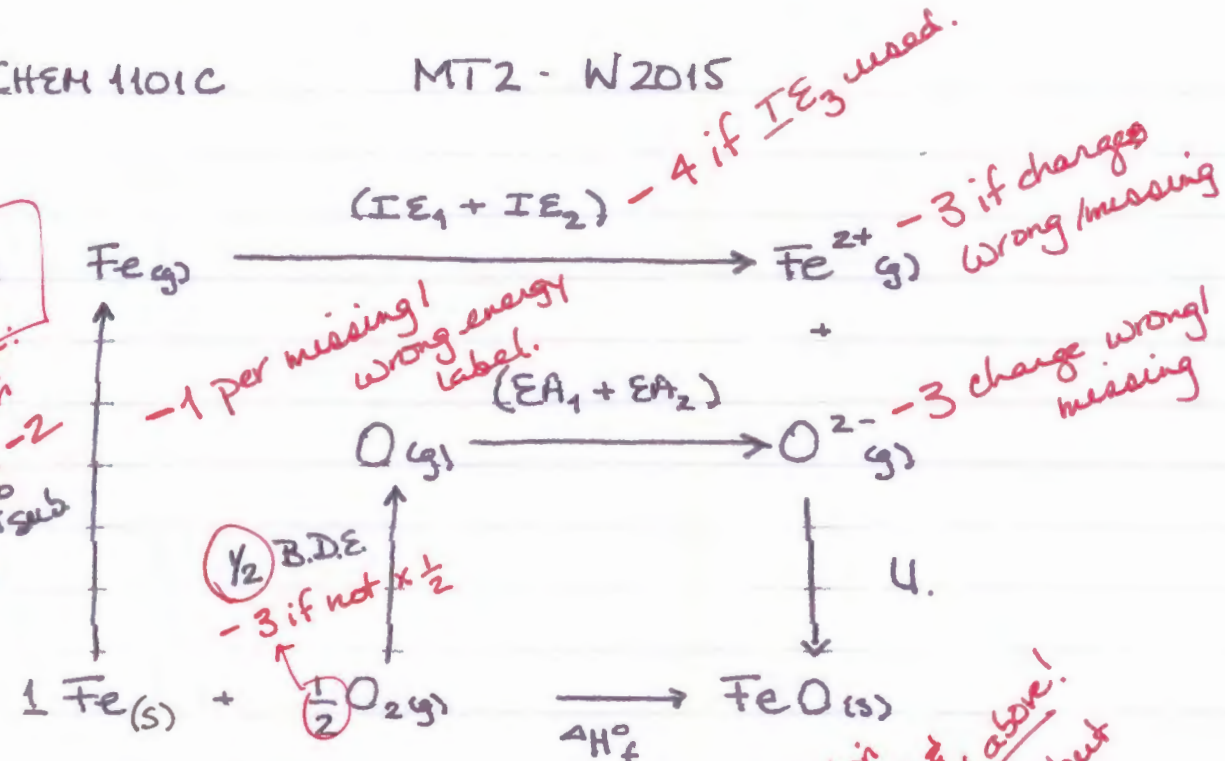
∅ if ideal gas eqn NOT used!

CHEM 1101C

MT2 - W2015

5. a)
15

If one phase forgotten:
no deduction
2-4 phases missing: -2
5+ missing: -4



No extra deduction if IE_3 used & deducted above! or if not $\times \frac{1}{2}$ but deducted above

b) $\Delta H_f^\circ = 1(\Delta H_{\text{sub}}^\circ) + 1(\text{IE}_1 + \text{IE}_2) + \frac{1}{2}(\text{B.D.E.}) + 1(\text{EA}_1 + \text{EA}_2) + U$

- 272 kJ = (417.7) + (762.5 + 1562) + $\frac{1}{2}$ (495) + (-133 + 247) + U

- 272 kJ = 3103.7 kJ + U

$U = [-3375.7] = -3376 \text{ kJ}$ (accept kJ/mol)

- 2 if units missing (wrong letters OK)

- 1 calc error

- 1 sig fig

- 4 if not $\Delta H_f^\circ = \text{Everything else!}$
 (or $U = \Delta H_f^\circ - \text{Everything else!}$)