Final Exam Practice Key

1) D

2) C

3) Atomic Mass = $\sum_n$ (fraction of isotope n) x (mass of isotope n)

$= 0.40(78.6\ \text{uma}) + 0.30(79.6\ \text{uma}) + 0.30(80.6\ \text{uma})$

$= 79.5\ \text{uma}$ (B)

4) The atomic # tells you the number of protons.

(C)

5) BrF_3

Br: 79.90 g/mol
F: 19.00 g/mol x 3 = 57

(e) 80:57

6) (C)

7) Na_2WO_4

$2Na^+ \quad WO_4^{2-}$

$Pb_3(PO_4)_4$

$3Pb^{4+} \quad 4PO_4^{3-}$

If $Pb_3(PO_4)_2$

$3Pb^{2+} \quad 2PO_4^{3-}$

Mistake on the test ∴ $PbWO_4$

$Pb_2(WO_4)_4$

$Pb(WO_4)_2$

But if correct then $Pb(WO_4)_2$ (D)

Then (A)

8) $0.532\text{g } Ca(OH)_2 \times \frac{\text{mol}}{74.0\text{g } Ca(OH)_2} = 0.00719 \text{ mol}$ (A)

9) $0.132\text{g H} \times \frac{\text{mol}}{1.01\text{g}} = \frac{0.1307 \text{ mol H}}{0.1307} \Rightarrow 1$

$1.423\text{g B} \times \frac{\text{mol}}{10.81\text{g}} = \frac{0.1316 \text{ mol B}}{0.1307} \Rightarrow 1$

$8.445\text{g S} \times \frac{\text{mol S}}{32.06\text{g}} = \frac{0.2634 \text{ mol S}}{0.1307} \Rightarrow 2$

HBS_2 (B)

10) (D)

11) (E)

12) (D)

But note that $Ba(OH)_2$ is not very water soluble.

13) $C_4H_8O_2 + 5O_2 \rightarrow 4CO_2 + 4H_2O$

C 4	C ~~4~~
H 8	H ~~8~~
O ~~12~~	O ~~12~~

(A) $5\ O_2 : 4\ CO_2$

14) $2\,NaBH_4(s) + I_2(s) \rightarrow B_2H_6(g) + 2\,NaI(s) + H_2(g)$

Na 2	Na 2
B 2	B 2
H 8	H 8
I 2	I 2

$$1.203\,g\,NaBH_4 \times \frac{mol\,NaBH_4}{37.85\,g} \times \frac{1\,mol\,B_2H_6}{2\,mol\,NaBH_4} \times \frac{27.69\,g}{mol} = 0.4400\,g$$

Percent yield $= \frac{\text{Actual yield}}{\text{theoretical yield}} \times 100\% = \frac{0.285\,g}{0.4400\,g} \times 100\% = 64.8\%$

(C)

15) $2.00\,L \times 0.100\,\frac{mol\,NaHCO_3}{L} \times \frac{84.0\,g}{mol} = 16.8\,g\,NaHCO_3$

(E)

16) $3\,BaCl_2 + 2\,Na_3PO_4 \rightarrow Ba_3(PO_4)_2 + 6\,NaCl$

$$0.025\,L\,BaCl_2 \times 0.150\,\frac{mol\,BaCl_2}{L} \times \frac{2\,mol\,Na_3PO_4}{3\,mol\,BaCl_2} \times \frac{L\,Na_3PO_4}{0.0500\,mol} = .100\,L$$

(C)

17) $2(2Al + \frac{3}{2}O_2 \rightarrow Al_2O_3)$

Al ~~4~~ ~~4~~ 4 Al ~~4~~ 4

O ~~6~~ ~~6~~ 6 O ~~6~~ 6

$4Al + 3O_2 \rightarrow 2Al_2O_3$

$12.0\,mol\ Al \times \frac{3\,mol\ O_2}{4\,mol\ Al} = 9\,mol\ O_2$

(D)

18) (D)

19) $Ba(OH)_{2(aq)} + H_2SO_{4(aq)} \rightarrow BaSO_{4(s)} + 2H_2O_{(l)}$

(A)

20) Combined mass of solution:

$5.0\,L\ water \times \frac{1.0\,g}{1\times10^{-3}\,L} = 5000\,g\ H_2O + 65.0\,g\ NaOH$

$\downarrow$

5065 g solution

$\%\ by\ mass = \frac{mass\ of\ solute}{mass\ of\ solution} \times 100\% = \frac{65}{5065} \times 100\% = 1.28\%$

21) $Pb(NO_3)_{2\,(aq)} + NaCl_{(aq)} \rightarrow NaNO_{3\,(aq)} + PbCl_{2\,(s)}$

(E)

22) $CS_2(g) + 2H_2O(l) \rightarrow CO_2(g) + 2H_2S(g)$

$2H_2O(l) + 2SO_2(g) \rightarrow 2H_2S(g) + 3O(g)$ $\Delta H = 1125.2\ kJ$

$CS_2(l) + 3O_2(g) \rightarrow CO_2(g) + 2SO_2(g)$ $\Delta H = -1075.2\ kJ$

$\Delta H = +500\ kJ$

(D)

23) $q_A = -q_B$ $\quad m_A = m_B$

$m_A \times C_{s,A} \times \Delta T_A = -m_B \times C_{s,B} \times \Delta T_B$

$m_A \times C_{s,A} \times \Delta T_A = -m_A \times C_{s,B} \times \Delta T_B$

$C_{s,A} \times (50 - 90\ ^\circ C) = -C_{s,B}(50 - 40)$

$C_{s,A}(-40^\circ C) = -10^\circ C\ C_{s,B}$

$4\ C_{s,A} = C_{s,B}$

(A)

24) $PV = nRT$

$n = \frac{PV}{RT} = \frac{(0.54)(3.00\ atm)}{(0.08206\ \frac{L \cdot atm}{mol \cdot K})(313.15K)} = 0.05837\ moles$

$V = \frac{nRT}{P} = \frac{(0.05837\ mol)(0.08206\ \frac{L \cdot atm}{mol \cdot K})(300.15K)}{1.20\ atm} = 1.20L$

(B)

25) (D)

$PV = nRT$

$n = \frac{PV}{RT}$ If P, V, + T are the same, n will be the same.

26) $PV = nRT$

$n = \frac{PV}{RT} = \frac{1.00\ atm\ (0.448L)}{0.08206\ \frac{L\ atm}{mol\ K}\ (273K)} = 0.019998\ mol$

$\frac{0.602g}{0.019998\ mol} = 30.1\ g/mol$ (D)

27) $P_1V_1 = P_2V_2$

$(1atm)(4L) = P_2(1L)$ (B)

$4atm = P_2$

28) A

29) In_2O_3

$In^{3+}\ O^{2-}$

$In^{3+}\ [Kr]\ 5s^2 4d^{10} 5p^1$ (C)

30) (B)

31) $4s^2 4p^3$ As (E)

32) (B)

33) Li [He] $3s^1$ $\frac{1}{3s}$

Be $[He]\,3s^2$ $\underset{3s}{\uparrow\downarrow}$ (B)

B $[He]\,3s^2 3p^1$ $\underset{3s}{\uparrow\downarrow}$ $\underset{3P}{\uparrow}$ _ _

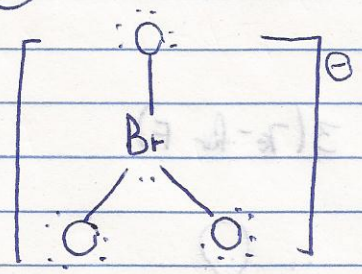
C $[He]\,3s^2 3p^2$ $\underset{3s}{\uparrow\downarrow}$ $\underset{3P}{\uparrow}$ $\uparrow$ _

N $[He]\,3s^2 3p^3$ $\underset{3s}{\uparrow\downarrow}$ $\underset{3p}{\uparrow}$ $\uparrow$ $\uparrow$

34) (C)

35) (E)

36) (D)

37) 

Formal charge (Br): = 7 − [2+3] = 2

(D)

38) (A) $[:\ddot{F}-\ddot{F}-\ddot{F}:]^-$

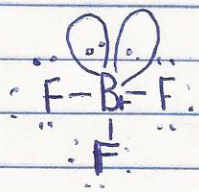
- Expanded octet but only a group 2 element
- Does not have energetically accessible d orbitals

39) (C) Ba O

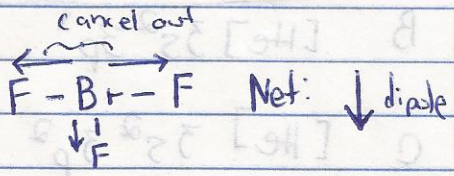
metal nonmetal

40) BrF_3 Valence $e^- = (7e^- \text{ for } Br) + 3 \times (7e^- \text{ for } F)$

$= 28e^-$



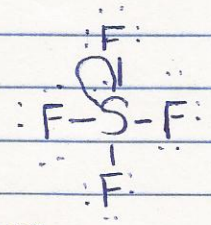
5 e^- groups



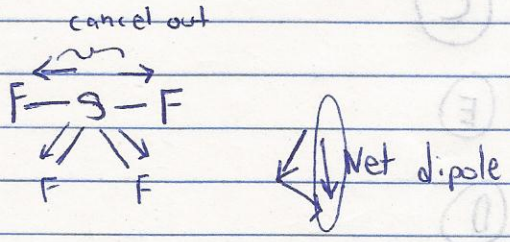
Polar

SF_4 Valence $e^- = (6e^- \text{ for } S) + 4 \times (7e^- \text{ for } F)$

$= 34e^-$



5 e^- groups



Polar

NF_3 Valence $e^- = 5e^- \text{ for } N + 3(7e^- \text{ for } F)$

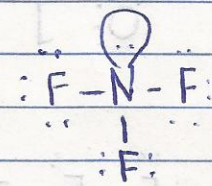
$= 26e^-$

Need $32e^-$

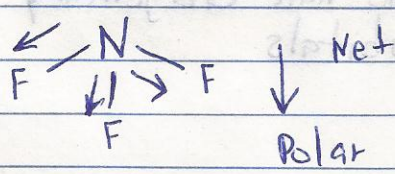
Valence $\underline{26e^-}$

$6e^- \div 2e^- = 3$ bonds

$26e^- - 6e^- = 20$ free electrons



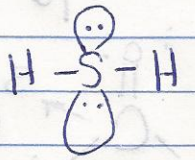
4 e^- groups



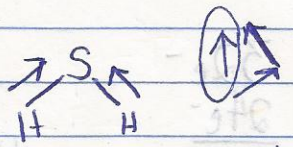
Polar

(9)

H_2S Valence e^- = 8e⁻



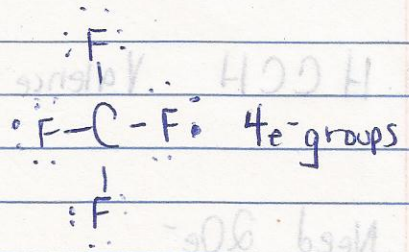
4e⁻ groups

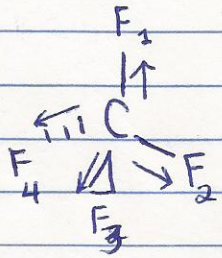


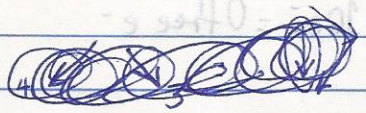
Net dipole
Polar

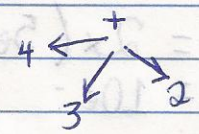
CF_4 Valence e^- = 4e⁻ for C + 4 × (7e⁻ for F)
= 32e⁻

Need 40e⁻
Valence 32e⁻
8e⁻ ÷ 2e⁻ = 4 bonds
32e⁻ − 8e⁻ = 24 free e⁻


4e⁻ groups







= Net of $C-F_4$ + $C-F_3$ + $C-F_2$

\+ $C-F_1$

0

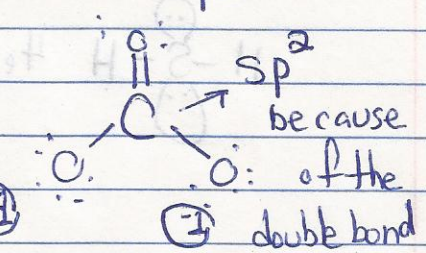
No dipole
Nonpolar

(E)

41) CO_3^{2-} Valence e^- = (4e⁻ for C) + 3(6e⁻ for O) + 2e⁻
= 24e⁻

72-

Need 32e⁻
Valence 24e⁻
8e⁻ ÷ 2e⁻ = 4 bonds
24e⁻ - 8e⁻ = 16 free e⁻



because of the double bond

B

42) HCCH Valence e^- = 2(4e⁻ for C) + 2($\frac{1}{2}$e⁻ for H)
= 10e⁻

Need 20e⁻
Valence 10e⁻
10e⁻ ÷ 2e⁻ = 5 bonds
10e⁻ - 10e⁻ = 0 free e⁻

H-C≡C-H

N_2 Valence e^- = 2x(5e⁻)
= 10e⁻

Need 10e⁻
Valence 10e⁻
6e⁻ ÷ 2e⁻ = 3 bonds
10e⁻ - 6e⁻ = 4 free e⁻

:N≡N:

NO^+ Valence $e^- = (5e^- \text{ for } N) + (6e^- \text{ for } O) - 1e^-$
$= 10e^-$

Need $16e^-$
Valence $\underline{10e^-}$
$6e^- \div 2e^- = 3$ bonds
$10e^- - 6e^- = 4$ free e^-

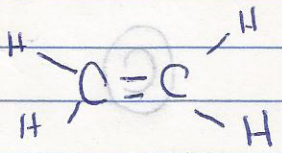
:N≡O:
+1

CN^- Valence $e^- = (4e^- \text{ for } C) + (5e^- \text{ for } N) + 1e^-$
$= 10e^-$

Need $16e^-$
Valence $\underline{10e^-}$
$6e^- \div 2e^- = 3$ bonds
$10e^- - 6e^- = 4$ free e^-

:C≡N:
-1

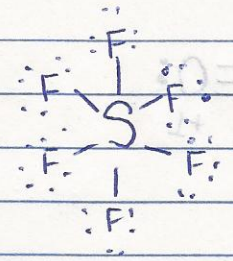
H_2CCH_2 Valence $e^- = 2 \times (4e^- \text{ for } C) + 4 \times (1e^- \text{ for } H)$
$= 12e^-$



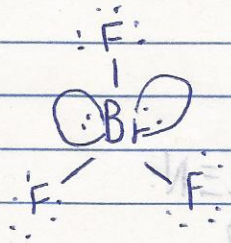
Need $24e^-$
Valence $\underline{12e^-}$
$12e^- \div 2e^- = 6$ bonds
$12e^- - 12e^- = 0$ free e^-

E

43) SF_6 Valence e^- = (6 e^- for S) + 6 × (7 e^- for F)
= 48 e^-

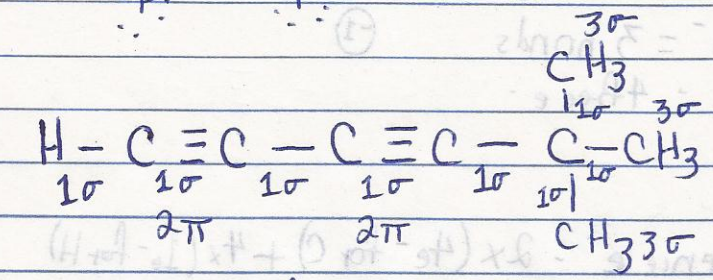


BrF_3 Valence e^- = (7 e^- for Br) + 3 × (7 e^- for F)
= 28 e^-



(B)

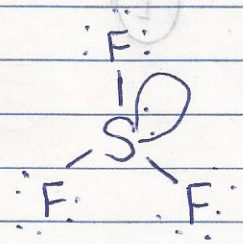
44)



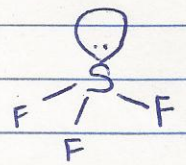
Total of 4π bonds

(C)

45) SF_3^+ Valence e^- = 6 e^- + 3(7 e^-) − 1 e^-
= 26 e^-



4 e^- groups



+ trigonal pyramidal

(A)