Write your answers on the answer sheet.

$E_{ke} = 1/2mv^2$ $p = mv$ $\lambda\, p = h$ $\Delta x \Delta p = h$ $h = 6.63 \times 10^{-34}$

1) Write the net ionic reactions for the following overall reactions (you may use $H^+ = H_3O^+$):
Be careful to write the proper charge with ions.
$Ba(NO_3)_2(aq) + Na_2SO_4(aq) \rightarrow BaSO_4(s) + 2NaNO_3(aq)$
$HCl + NH_3 \rightarrow NH_4Cl$

2) Finish the following Brønsted–Lowry reactions.
$H_3O^+ + H_2NNH_2 \rightleftharpoons$
$H_3CCOOH + OH^- \rightleftharpoons$
$HNO_3 + CH_3NH_2 \rightleftharpoons$
$HF + NH_3 \rightleftharpoons$

3) What is the wavelength of a proton that has an energy of 1.24×10^{-26} kJ.
$h = 6.63 \times 10^{-34}$ $m_{p+} = 1.67 \times 10^{-24}$

4) What is the uncertainty in the momentum of a neutron that is confined to a space of 4.8 nm.
$h = 6.63 \times 10^{-34}$ $m_{no} = 1.67 \times 10^{-24}$

5) For the following atoms, give the four electron quantum numbers that the highest energy electron in the ground state could have. Cl , P , B , and S

6) Write the electron configuration, according to the aufbau principle based on the hydrogen atom, for the following atoms.
Cd , O , Mn , and Al

Draw the Lewis dot structure for the following compounds/ions:

7) HOH 8) H_2NNH_2 9) HCCH
10) H_2CCH_2 11) NH_4^+ 12) SO_2
13) CO_3^{2-} 14) SF_5^- 15) IF_2^-

16) Which of the following have the rotation hindered? Tell why it the roatation is or is not hindered.
FCN ClH_2CCH_2Cl

17) Which of the following have the rotation hindered. Tell why it the roatation is or is not hindered.
HCN H_2CCH_2

18) Give the product for each of the following reactions. For each there is only one product. (You do not need to balance the reactions.)
$N_2 + I_2 \rightarrow$ $N_2 + Br_2 \rightarrow$

19) Give the products for each of the following reactions. For each there are two products. (You do not need to balance the reactions.)
$S_8 + Cl_2 \rightarrow$ $P_4 + Cl_2 \rightarrow$

20) An unknown molecule diffuses 1.38times faster than Xe (molar mass of 131.3 g mol^{-1}). What is the unknown's molar mass?

ANSWER SHEET – 1st page

NAME_____

Be sure to include units where needed. No units – no credit!

1) $Ba(NO_3)_2(aq) + Na_2SO_4(aq) \rightarrow BaSO_4(s) + 2NaNO_3(aq)$

_____ ⇌ _____

$HCl + NH_3 \rightarrow NH_4Cl$

_____ ⇌ _____

2) $H_3O^+ + H_2NNH_2 \rightleftharpoons$ _____ + _____

$H_3CCOOH + OH^- \rightleftharpoons$ _____ + _____

$HNO_3 + CH_3NH_2 \rightleftharpoons$ _____ + _____

$HF + NH_3 \rightleftharpoons$ _____ + _____

3) $\lambda =$ _____

4) $p =$ _____

5) For Cl n = _____ l = _____ m_l = _____ m_s = _____

For P n = _____ l = _____ m_l = _____ m_s = _____

For B n = _____ l = _____ m_l = _____ m_s = _____

For S n = _____ l = _____ m_l = _____ m_s = _____

6) For Cd :_____

For O :_____

For Mn :_____

For Al :_____

ANSWER SHEET – 2nd page

NAME_____

7) HOH :

8) H_2NNH_2 :

9) HCCH :

10) H_2CCH_2 :

11) NH_4^+ :

12) SO_2 :

13) CO_3^{2-} :

14) SF_5^- :

ANSWER SHEET – 3rd page

NAME_____

15) IF_2^- :

16) FCN: _____

ClH_2CCH_2Cl: _____

17) HCN: _____

H_2CCH_2: _____

18) $N_2 + I_2 \rightarrow$ _____

$N_2 + Br_2 \rightarrow$ _____

19) $S_8 + Cl_2 \rightarrow$ _____

$P_4 + Cl_2 \rightarrow$ _____

20) Molar Mass = _____

KEY – 1st page

1) $Ba(NO_3)_2(aq) + Na_2SO_4(aq) \rightarrow BaSO_4(s) + 2NaNO_3(aq)$

$Ba^{2+} + SO_4^{2-} \rightleftharpoons BaSO_4$

$HCl + NH_3 \rightarrow NH_4Cl$

$H^+ + NH_3 \rightleftharpoons NH_4^+$

2) $H_3O^+ + H_2NNH_2 \rightleftharpoons H_2O + H_2NNH_3^+$

$H_3CCOOH + OH^- \rightleftharpoons H_3CCOO^- + H_2O$

$HNO_3 + CH_3NH_2 \rightleftharpoons NO_3^- + CH_3NH_3^+$

$HF + NH_3 \rightleftharpoons F^- + NH_4^+$

3) $\lambda =$ 3.26×10^{-9} m

4) $p =$ 1.38×10^{-25} kg m s^{-1}

5) Cl n = 3 l = 1 $m_l = -1, 0, +1$ $m_s = +1/2, -1/2$

P n = 3 l = 1 $m_l = -1, 0, +1$ $m_s = +1/2, -1/2$

B n = 2 l = 1 $m_l = -1, 0, +1$ $m_s = +1/2, -1/2$

S n = 3 l = 1 $m_l = -1, 0, +1$ $m_s = +1/2, -1/2$

6) For Cd : $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^{10}, 4p^6, 5s^2, 4d^{10}$

For O : $1s^2, 2s^2, 2p^4$

For Mn : $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^5$

For Al : $1s^2, 2s^2, 2p^6, 3s^2, 3p^1$

KEY – 2nd page

7) HOH :

8) H_2NNH_2 :

9) HCCH :

10) H_2CCH_2 :

11) NH_4^+ :

12) SO_2 :

13) CO_3^{2-} :

14) SF_5^- :

KEY – 3rd page

15) IF_2^- :

16) FCN : not hindered – triple bonded

ClH_2CCH_2Cl : not hindered – single bonded

17) HCN : not hindered – triple bonded

H_2CCH_2 : hindered – double bond

18) $N_2 + I_2 \rightarrow$ NI_3

$N_2 + Br_2 \rightarrow$ NBr_3

19) $S_8 + Cl_2 \rightarrow$ SCl_2 and SCl_6

$P_4 + Cl_2 \rightarrow$ PCl_3 and PCl_5

20) Molar Mass = 69.3 g mol^{-1}