I(1):

As Ne has 10 electrons, the ion with 10 electrons has the same electron configuration as it. As Mg has 12 electrons, Mg^{2+} ion has 10 electrons. Therefore, Mg^{2+} $\boxed{(2)}$ has the same electron configuration as the Ne atom.

I(2):

Among single bond, double bond, and triple bond, single bond has the longest bond distance.

H_2 and Cl_2 are bonded by a single bond. However, as the molecular size of Cl atom is larger than that of H atom, Cl_2 $\boxed{(4)}$ has the longest bond distance.

I(3):

1) Silicon is a covalent (atomic) crystal.

2) NaCl is an ionic crystal.

3) Calcium is a metallic crystal.

$\boxed{4)}$ Iodine is a molecular crystal.

I(4):

The acidity of acid is determined by the degree of dissociation of H^+ in water. As HF molecules are bonded by hydrogen bonds, it is very difficult for H^+ ions to dissociate. Therefore, HF $\boxed{(1)}$ has the lowest acidity.

I(5):

1) Phosphorus is group 15 element.

$\boxed{2)}$ Phosphorus has allotropes: white phosphorus and red phosphorus. Sulfur has allotropes: rhombic sulfur, monoclinic sulfur and plastic sulfur.

3) SO_2 is a gas.

4) Both oxides produce acidic solutions when dissolved in water.

I(6):

$\boxed{1)}$ $2F_2 + 2H_2O \rightarrow 4HF + O_2$ (redox)

2) $Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$ (displacement)

3) $2K + 2H_2O \rightarrow 2KOH + H_2$ (redox)

4) $CuO + 2HCl \rightarrow CuCl_2 + H_2O$ (double displacement)

I(7):

$\boxed{2)}$ Aluminium is extracted by electrolysis of molten aluminium ore.

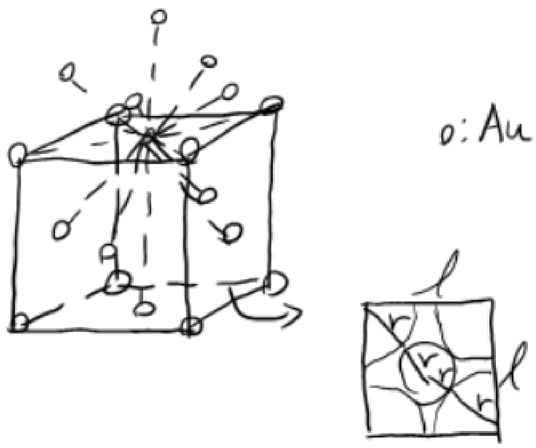
II:

(1): The reaction between ammonia and oxygen (the first step of Ostwald's process) is given by:

$4NH_3 + \boxed{5}O_2 \rightarrow \boxed{4}NO + \boxed{6}H_2O$

Note: The equation can be balanced easily as the coefficient of NH_3 is given.

(2): Referring to the figure:



There are $\frac{1}{8} \cdot 8 + \frac{1}{2} \cdot 6 = \boxed{4}$ atoms in a unit cell. Moreover, 1 atom is surrounded by $\boxed{12}$ nearby atoms.

Now, consider one face of the unit cell, we have $\sqrt{2}l = 4r$, therefore, the radius of Au atom is approximately $0.41 \cdot \frac{1.4}{4} = \boxed{0.14}\ nm$. The weight of one Au atom$=\frac{197}{6.0\times10^{23}}\ g$. Therefore, the total weight of Au atoms in a unit cell$=4 \cdot \frac{197}{6.0\times10^{23}}\ g$. As the volume of a unit cell$=0.41^3\ nm^3$, we have the density of gold$=\frac{4\cdot\frac{197}{6.0\times10^{23}}}{0.41^3\cdot(10^{-9})^3} \approx \boxed{19}\ g\ cm^{-1}$.

III:

Background: For ideal gas, we have the ideal gas equation $pV = nRT$.

(1): When T is constant, V is inversely proportional to p. Therefore, the graph is $\boxed{(f)}$.

(2): When V is constant, P is directly proportional to T . Therefore, the graph is $\boxed{(b)}$.

(3): When the amount of gas, i.e. n is constant, $\frac{pV}{T}$ is constant. Therefore, the graph is $\boxed{(d)}$.

(4-1): The partial pressure of water vapour=$3 \times 10^3\ Pa$.

Therefore, the partial pressure of nitrogen=$4.3 \times 10^4 - 3 \times 10^3 = \boxed{4.0 \times 10^4}\ Pa$.

(4-2): The partial pressure of water vapour is constant with volume.

When the volume is decreases to 2.0 L under constant temperature, the partial pressure of nitrogen becomes $4.0 \times 10^4 \cdot \frac{3.0}{2.0} = 6.0 \times 10^4\ Pa$. Therefore, the total pressure=$3 \times 10^3 + 6.0 \times 10^4 = \boxed{6.3 \times 10^4}\ Pa$.

IV:

(1): Referring to the table:

Chemical	N_2	H_2	NH_3
Number of moles before reaction	3.0	9.0	0
Number of moles after reaction	$3-x$	$9-3x$	$2x$

As the molar fraction of NH_3 is 50%, we have $\frac{2x}{3-x+9-3x+2x} = 0.5$, i.e. $x = 2$.

Therefore, the number of moles of N_2, H_2 and NH_3 are $\boxed{1.0}$, $\boxed{3.0}$ and $\boxed{4.0}$ respectively.

(2): As 3 mol of products formed, the amount of heat generated

$=3 \cdot \frac{92}{2} = \boxed{184}\ kJ$.

Note: The enthalpy change given is not the standard one. 2 mol of products are formed instead of 1 mol.

(3): As volume is proportional to the number of moles under constant pressure and temperature, we have the pressure after reaction$=3.0 \cdot \frac{1.0+3.0+4.0}{3.0+9.0} = \boxed{2.0}\ L$.

(4): $K_C = \frac{[NH_3]^2}{[N_2][H_2]^3} = \frac{(\frac{4}{2})^2}{(\frac{1}{2})(\frac{3}{2})^3} \approx \boxed{2.4\ mol^{-2}\ L^2}$

(5):

1) The reaction rate will increase with the final yield unchanged. Therefore, line $\boxed{A}$ will be obtained.

2) As the reaction is exothermic, by Le Chatelier's principle, the equilibrium

position will shift to the left, i.e. the yield will decrease. However, high temperature increases the reaction rate. Therefore, line $\boxed{D}$ will be obtained.

(6): As the concentration of reactant decreases with time, the rate should also decrease with time. At the end, as equilibrium is reached, apparently, no more NH3 is formed, and the rate drops to 0. Therefore, $\boxed{I}$ is correct.

Note: If it is not the apparent rate but measured, the rate will never drop to zero as dynamic equilibrium is reached.

V:

(1): The mass of C atom in A=$110 \cdot \frac{12.0}{12.0+2 \cdot 16.0} = 30\ mg$.

The mass of H atom in A=$40.5 \cdot \frac{2 \cdot 1.0}{2 \cdot 1.0+16.0} = 4.5\ mg$.

The mass of O atom in A=50.5-30-4.5=16 mg.

Consider the molar ratio C:H:O=$\frac{30}{12} : \frac{4.5}{1.0} : \frac{16}{16} = 5 : 9 : 2$. We have the empirical formula of A is $C_5H_9O_2$.

Now, consider the molecular mass of A, $n(5 \cdot 12.0 + 9 \cdot 1.0 + 2 \cdot 16.0) < 300$, we have $n < 3$. Therefore, the molecular formula of A is either $C_5H_9O_2$ or $C_{10}H_{18}O_4$.

We first identify that B is an alcohol as it reacts with sodium to give hydrogen gas and can be oxidised to aldehyde (which gives a positive Tollens' test).

The hydrolysis of an ester linkage gives alcohol and carboxylic acid in a ratio of 1:1. Therefore, we can conclude that A contains two ester linkages with one carboxylic acid. Then, the number of O in A should be 4. Hence, we have the molecular formula of A $C_{\boxed{10}}H_{\boxed{18}}O_{\boxed{4}}$.

(2): By the deduction above, C is $HOOC-(CH_2)_n-COOH$ and B is $H_3C(CH_2)_mOH$. Consider the total number of carbons in A, we have $2+n+2(1+m)=10$, i.e. $n+2m=6$.

On the other hand, E is $H_3C(CH_2)_m - COOH$. As E shows positive result of iodoform reaction, it is in the form of H_3CCOR. Therefore, we have $m-1=0$, i.e. $m=1$ and hence $n=4$.

Therefore, B is CH_3CH_2OH $\boxed{(3)}$ and C is $HOOC(CH_2)_4COOH$ $\boxed{(18)}$.

Moreover, oxidation of B gives D, CH_3CHO $\boxed{(6)}$ and further oxidation of it gives E, CH_3COOH $\boxed{(7)}$.

(3): The synthesis of nylon-6,6 uses $HOOC-(CH_2)_4-COOH$ and $H_2N-(CH_2)_6-NH_2$. Therefore, F is $C_{\boxed{6}}H_{\boxed{16}}N_{\boxed{2}}$.

VI:

(1):

a) The monomer is styrene $\boxed{(3)}$.

b) The monomer is vinyl chloride $\boxed{(4)}$.

c) The monomer is propylene $\boxed{(2)}$.

(2): The two monomers of polyethylene terephthalate are ethane-1,2-diol $\boxed{(12)}$ and terephthalic acid $\boxed{(8)}$.

(3): The molecular mass of ethane-1,2-diol$=2 \cdot 12.0 + 6 \cdot 1.0 + 2 \cdot 16.0 = 62$

The molecular mass of terephthalic acid

$=(6 \cdot 12.0 + 4 \cdot 1.0) + 2 \cdot (12.0 + 2 \cdot 16.0 + 1.0) = 166$

After condensation, two H_2O molecules (molecular mass 18) are formed.

Therefore, the molecular mass of the repeating unit$=62 + 166 - 2 \cdot 18 = 192$.

Hence, the average degrees of polymerisation$=\frac{2\times10^4}{192} \approx \boxed{104}$.

Note: One can also calculate the molecular mass of the repeating unit directly, but that will be clumsier.

(4): The repeating unit of amylose is $C_6H_{10}O_5$, which has a molecular mass of $6 \cdot 12.0 + 10 \cdot 1.0 + 5 \cdot 16.0 = 162$.

Therefore, $\frac{2.70\times10^5}{162} \approx \boxed{1670}$ molecules of glucose are reacted.

(5): The mechanism of the iodine test is that the iodine molecules are bounded by the helical structure and show blue colour. However, cellulose does not have a helical structure $\boxed{(2)}$ which causes the negative result of iodine test.