## EXERCISE 11.A

**Part 1**

1. Distinguish between isothermal and adiabatic changes, clearly stating the conditions under which they occur in practice.
2. Define the two principal molar heat capacities of a gas and derive an expression relating the two. Explain the difference between these two principal molar heat capacities.
3. A quantity of oxygen is compressed isothermally until its pressure is doubled, it is then allowed to expand adiabatically until its original volume is restored. Find the final pressure in terms of its original pressure. Draw a PV diagram for the above processes.
4. A $0.45m^3$ of a gas at a temperature of $15^oC$ expands adiabatically and its temperature falls to $4^oC$.

a) What is the new volume if $\gamma = 1.40$

b) The gas is then compressed isothermally until the pressure returns to its original value. Calculate the final volume of the gas.

5. A vessel containing 2m3 of air initially at a temperature 25o C and pressure 760mmHg, is heated at constant pressure until its volume is doubled. Find :

a) the final temperature

b) the external work done by the air in expanding,

c) the quantity of heat supplied.

6.(Assume that the density of air at s.t.p is 1.293 $kgm^{-3}$ and that the principal molar heat capacity of air at constant volume is 20.4 $Jmol^{-1}K^{-1}$.An ideal gas at a temperature $45^oC$ and pressure$1x10^5Nm^{-2}$ occupies a volume of $2x10^{-3}m^3$. It expands adiabatically to twice its volume. Find the final temperature and pressure. Represent this process on PV- diagram. (Take $\gamma = 1.4$)

**Part 2**

1. a) i) What is meant by a reversible isothermal change?

ii) State the conditions for achieving a reversible isothermal change.

b) i) What is meant by adiabatic change?

ii) An ideal gas at $27^oC$ and a pressure of $1.01x10^5$ Pa is compressed reversibly and isothermally until its volume is heated. It is then expanded reversibly and adiabatically to twice its original volume. Calculate the final pressure and temperature of the gas if a=1.4.

2. a) Explain why the specific heat of a gas at constant pressure is higher than that at constant volume.

b) The density of an ideal gas is 1.6 $kgm^{-3}$ at $27^oC$ and $1\times10Nm^2$ pressure and specific heat capacity at constant volume is $0.312KJkg^{-1}$. Find the ratio of the specific heat capacity at constant pressure to that at constant volume. Point out any significance attached to the result.

3. a) Explain why the cooling compartment of a refrigerator is always on top.

b) The refrigerator cools substances by evaporation of a volatile liquid. Explain how evaporation causes cooling.

c) State the reason why water is used in the cooling system of a car engine.

4. a) With the aid of a labelled diagram, describe how a refrigerator works.

b) The cooling system of a refrigerator extracts 0.7 Kw of heat. How long will it convert 500g of water at $20^oC$ to ice?

c) Explain how evaporation takes place in the refrigerator.

d) Explain why water in a porous pot keeps at a lower temperature than that of the surrounding.