

NAME.....Combn.....

P525/1

CHEMISTRY

PAPER 1

UGANDA ADVANCED CERTIFICATE OF EDUCATION
TERM TWO EXAMINATION, 2024
CHEMISTRY
PAPER 1
2 HOURS 45 MINUTES

Instructions to Candidates:

- Answer all questions in sections **A** and **6** questions in section **B**.
- All questions must be answered in spaces provided.
- Illustrate your answers with equation(s) where applicable.

Where necessary use the following;

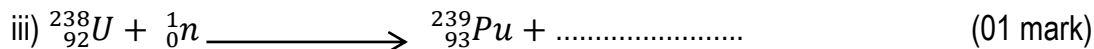
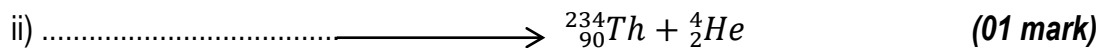
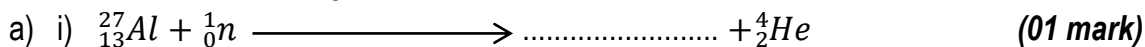
- Molar gas constant $R = 8.31 JK^{-1}mol^{-1}$
- Molar volume of a gas at s.t.pts 22.4 litres
- Standard temperature = 273K
- Standard pressure = $101325 Nm^{-2}$

FOR EXAMINERS' USE ONLY

SECTION A	
SECTION B	
TOTAL	

SECTION A

1. Complete the following equations.



b) The mass of a radioisotope, T , reduced by 32% in 40 days. Calculate the half life of T .

(2 $\frac{1}{2}$ marks)

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2. The first ionization energies of some elements are shown in the table below.

Elements	Ionization energies(KJ mol ⁻¹)			
	1	2	3	4
A	500	4600	6900	9500
B	740	1500	7700	10,500
C	630	1600	3000	4800
D	900	1800	14,800	21,000
E	580	1800	2700	11,600

a) What is meant by the term ionization energy?

(02 marks)

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b) (i) State the element that is most likely to form an ion with unit positive.

(01 mark)

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(01 mark)

4. The table below shows the melting points of the oxides of group (II) elements.

Oxides	<i>BeO</i>	<i>MgO</i>	<i>CaO</i>	<i>SrO</i>	<i>BaO</i>
Melting points of oxides in (°C)	2530	2800	2580	2430	1928

Explain the trend in the melting points of these oxides.

(5½ marks)

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5. A compound *Q* contains 60% carbon, 33.3% hydrogen and the rest being oxygen.

W 0.698*g* of *Q* was dissolved in 100*g* of a solvent. (*k_f* of the solvent

= 1.63°C*kg*⁻¹*mol*⁻¹).

a) Calculate the simplest formula of *Q*.

(03 marks)

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b) Determine the molecular formula of *Q*

(02½ marks)

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6. (a) Explain what is meant by diagonal relationship.

(1 mark)

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(b) Write the electronic configuration of the following elements.

(2 marks)

i) Beryllium

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ii) Aluminium

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(c) State any two reasons as to why beryllium resembles aluminium in its properties.

($2\frac{1}{2}$ marks)

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7. (a) Define the term boiling point constant of a substance.

($\frac{1}{2}$ mark)

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(b) State any two colligative properties of a solution.

(01 mark)

(c) 2.00g of phosphorus raise the boiling point of 37.4g of carbon disulphide by 1.003°C .

- i) Calculate the molar mass of phosphorus in carbon disulphide. (kb for carbon disulphide is $2.35^{\circ}\text{C mol}^{-1}\text{kg}^{-1}$). (01½ marks)

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- ii) Hence determine the molecular formula of phosphorus in carbon disulphide (P = 31) (01 mark)

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- iii) Comment on the results in C(iii) above. (01 mark)

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8. The table below shows the ionization energies of group VII elements.

Element	<i>F</i>	<i>Cl</i>	<i>Br</i>	<i>I</i>
Atomic radius (nm)	0.072	0.099	0.114	0.133
Ionic radius (nm)	0.136	0.181	0.195	0.216

- a) Define the term atomic radius. (01 mark)

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b) State and explain the trend in atomic radius of the elements. **(02 $\frac{1}{2}$ marks)**

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c) Explain why the ionic radius is larger than the atomic radius of the corresponding neutral atom for each element. **(2 marks)**

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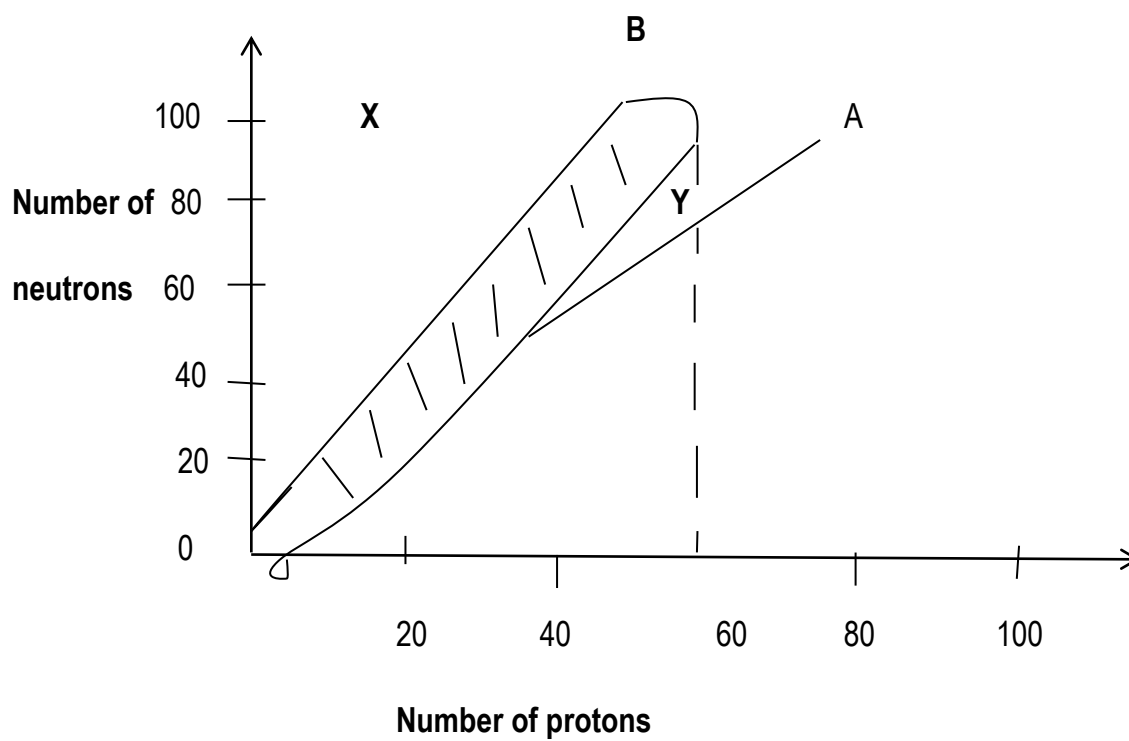
9. (a)(i) What is meant by stability of nucleus? **(01 mark)**

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(ii) Explain the factors that determine the stability of a nucleus



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b(i) State what lines **A** and **B** represent.

(1½ marks)

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(ii) Explain element *x* and *y* can gain stability.

(03 marks)

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SECTION B

10. A compound *Q* contains 54.5% carbon, 9.09% hydrogen and the rest being oxygen.

a) Calculate the empirical formula.

(04½ marks)

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b) 0.542g of *Q* occupies 148cm³ at a temperature of 20°C and a 740mmHg. Determine the molecular of *Q*.

(04½ marks)

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11. (a)(i) Write electronic configuration of chromium (atomic number = 24) (01 mark)

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(ii) Give the common oxidation states exhibited by chromium and in each case, write the formula of one compound of chromium. (03 marks)

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(b) Discuss the reactions of chromium with

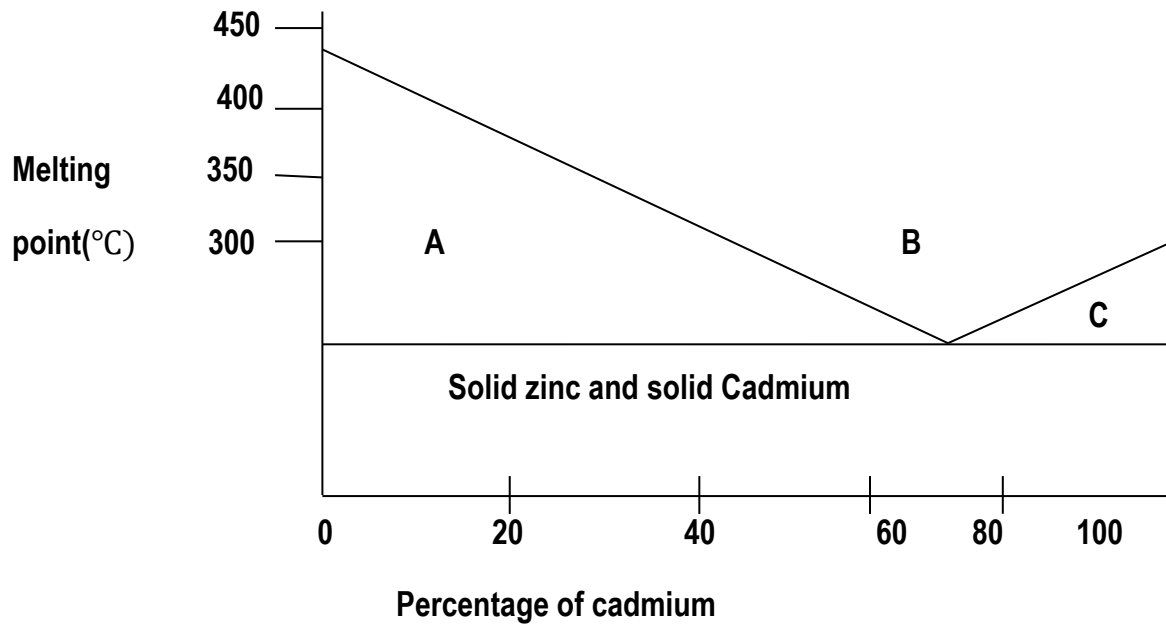
i) Sodium hydroxide (03 marks)

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ii) Air (03 marks)

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12. (a) The graph below shows the variation in melting point of a mixture of zinc and cadmium with composition.



- i) Determine the eutectics point of the system.

(02 marks)

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- ii) Name the phases in the region **A**, **B** and **C**.

(01 $\frac{1}{2}$ marks)

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- b) Describe the changes that take place when a mixture containing 88% zinc is cooled from 450°C to 280°C.

(5 $\frac{1}{2}$ marks)

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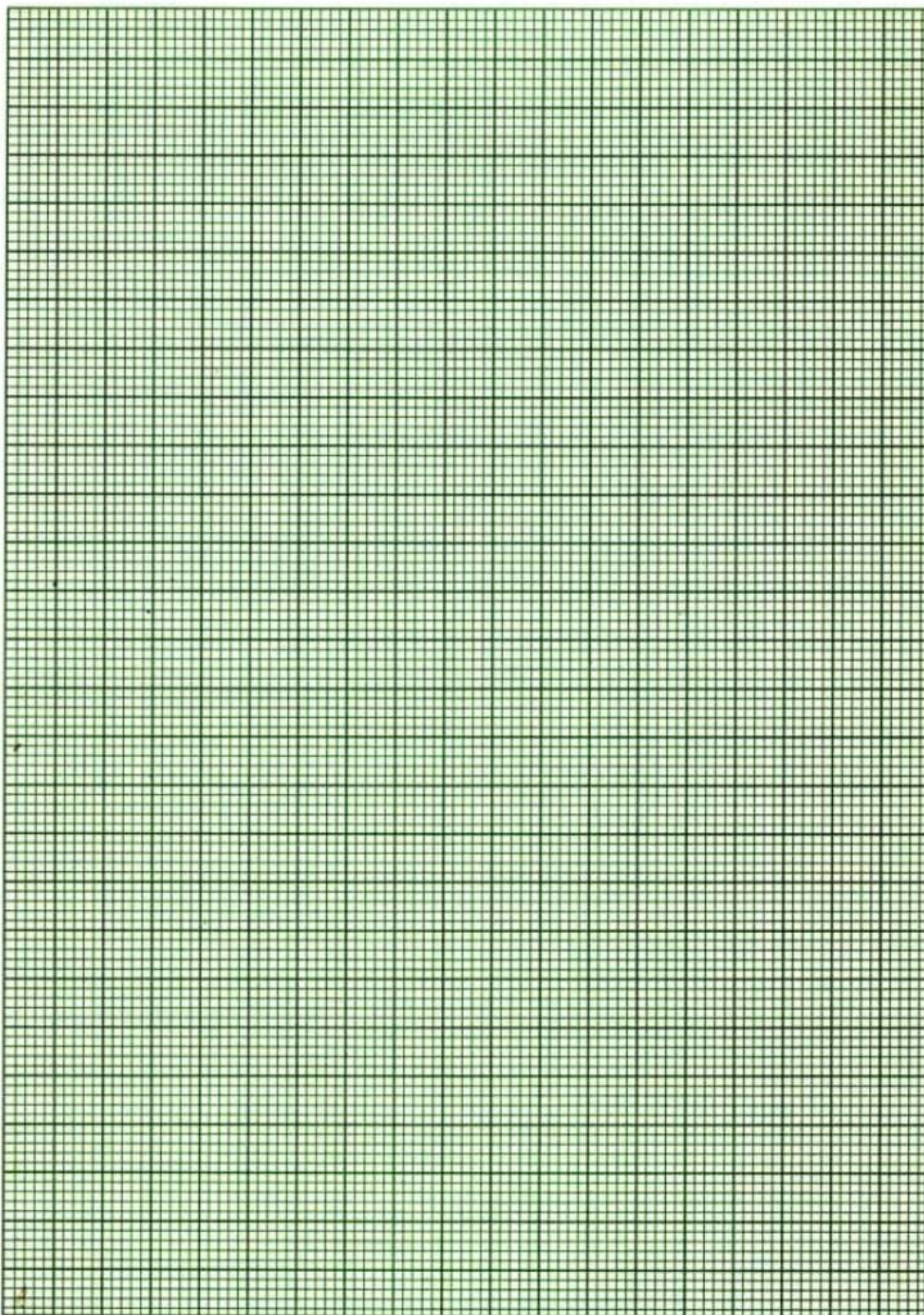
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13. (a) The table

Chain alkanes

Alkane	CH_4	C_2H_6	C_3H_8	C_4H_{10}	C_5H_{12}	C_6H_{14}	C_7H_{16}
Boiling point ($^{\circ}C$)	-62	-89	-42	-0.5	36	69	98

i) Plot a graph of boiling point against molecular mass of alkane, **(03 marks)**



ii) From your graph in (i) above, determine the boiling of octane. (02 marks)

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iii) Explain the trend in boiling points of alkane. (04 marks)

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14. Explain the following phenomenones.

a) The first electron affinity of magnesium is lower than the rest. (03 marks)

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b) The first electron affinity of aluminium is higher than that of magnesium. (03 marks)

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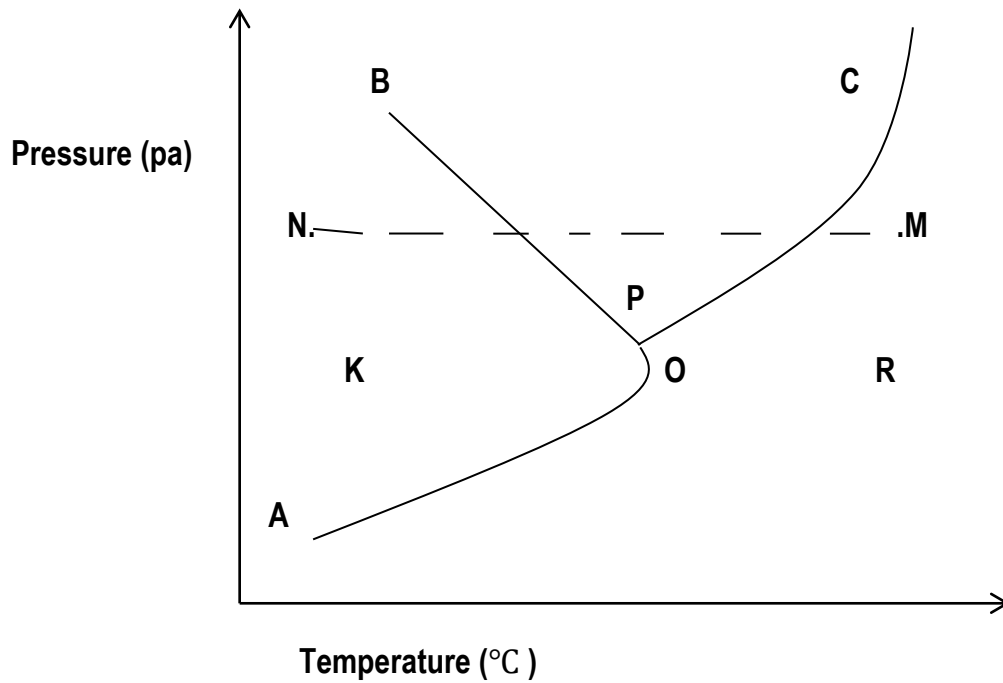
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c) The first electron affinity of phosphorus is lower than that of sulphur. (3 marks)

15. The phase diagram below is of water system.



a) (i) i) Name the phases , *K*, *P* and *R* (01 $\frac{1}{2}$ marks)

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(ii) ii) Explain why line *OB* slopes upwards and to the left. (02 marks)

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b) Explain what happens to phase at *N* when it is being changed to phase at *M*.

(05 $\frac{1}{2}$ marks)

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16. Distinguish the following solutions consisting of;

a) $Ba(NO_3)_2$ and Ba_2CO_3

(03 marks)

Reagent:

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Observation:

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b) $Zn(NO_3)_2$

(03 marks)

Reagent:

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Observation:

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c) $Al_2(CO_3)_3$ and $PbCO_3$

(03 marks)

Reagent:

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Observation:

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17. 0.539g of a vapourised sample of gas X occupies 200cm^3 at a temperature of 373K and a pressure of 0.938 atm . Calculate the relative molecular mass of X . (02 marks)

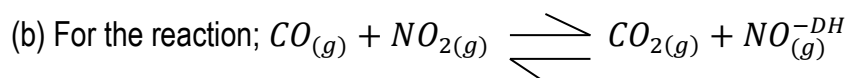
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i) Draw a well labeled energy level diagram for the reaction. (04 marks)

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ii) The activation energies for the forward and reverse reactions are known to be respectively 32KJmol^{-1} and 82.1KJmol^{-1} . Calculate the activation energy. (03 marks)

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END