4 – SPECIMEN EXAMINATION QUESTIONS

The Chemistry of Life

1. (a) (i) Name **two** secondary structures in proteins.

I ..... **II** .....

(ii) Draw simplified diagrams of each structure, showing the bonding by which each is stabilised.

I **II**

[4]

(b) ATP is an important molecule associated with the supply of energy in cells. Write a simple equation to represent the hydrolysis of ATP.

..... [1]

(c) The following results were obtained at different concentrations of ATP for the rate of hydrolysis in the presence of the enzyme myosin.

[ATP] /mmol dm^{-3}	0.025	0.050	0.075	0.100	0.150	0.200	0.300
rate /mmol dm^{-3} s^{-1}	0.0065	0.0115	0.0140	0.0158	0.0176	0.0187	0.0196

(i) Use graph paper to plot these results, plotting [ATP] on the x-axis, and rate on the y-axis.

(ii) ADP is an inhibitor for this reaction, suggest what type of inhibitor it is.

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(iii) What would be the effect of ADP on the rate of the reaction at low [ATP]?

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(iv) What would be the effect of ADP on the rate of the reaction at high [ATP]?

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[6]

Applications of Analytical Chemistry

2. (a) (i) State what is meant by the term partition coefficient.

(ii) A solution of 5.00 g of an organic compound X in 50 cm^3 of water was shaken with 100 cm^3 of ether. After separation, the aqueous solution was found to contain 0.80 g of X.

Determine the partition coefficient of X between ether and water.

[4]

(b) Explain briefly how the separation of different components in mixtures is achieved in each of the following chromatographic techniques.

(i) paper chromatography

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(ii) thin layer chromatography

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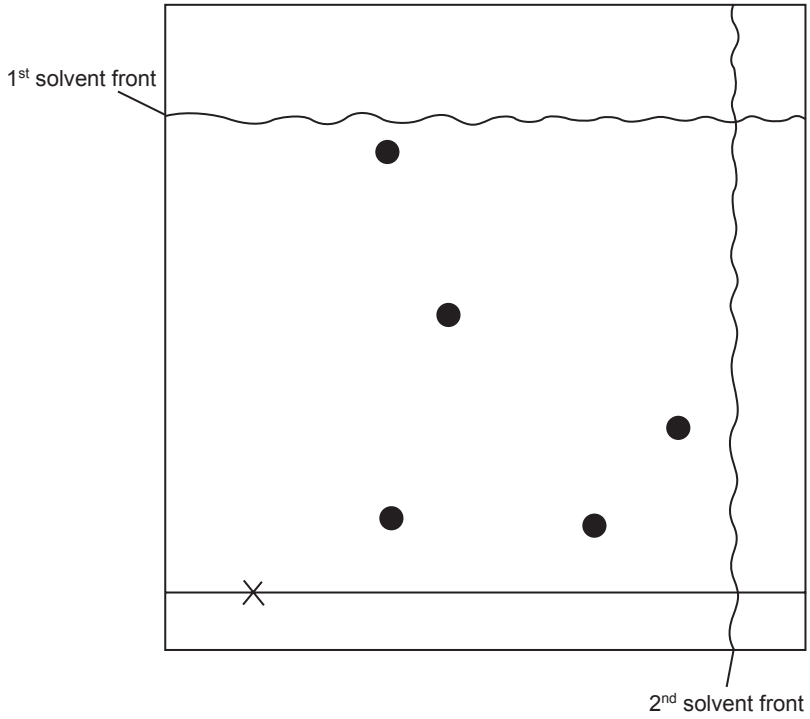
(c) The diagram shows a two-way chromatogram carried out on the products of the hydrolysis of a polypeptide.



x = start point

(i) How many different amino acids were present in the sample?

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(ii) What could have been use to make the spots visible?

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(iii) Sketch the chromatogram you might expect if only the first solvent had been used.

[4]

Materials and Design

3. **(a)** State what you understand by the term *nanotechnology*.

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[2]

(b) 'Nanotubes' are rolled up cylinders of graphite with diameters of about 1 nanometre, and lengths micrometres.

(i) If a nanotube is 5 micrometres long, how many diameters does this represent?

(ii) These tubes are believed to be stronger than steel. Suggest a possible use for nanotubes.

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(iii) One problem in the synthesis of nanotubes is that a mixture of tubes of different length and orientations is produced. Suggest why this is a problem.

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[5]

(c) The delivery of cancer-destroying drugs has, in the past, been by injection of the relevant drug into the bloodstream, allowing it to be carried around the body to the tumour. New techniques have been developed which rely on binding the relevant drug molecule to an enzyme.

Suggest the advantages of this new technique, both in economic terms and in terms of the effect on the patient.

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