**HL IB Biology I – Data Analysis (Paper 2) Practice #1** Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Block: \_\_\_\_

**1.** A study was carried out to determine the relationship between the diameter of a molecule and its movement through a membrane. The graph below shows the results of the study.



(a) From the information in the graph alone, describe the relationship between the diameter of a molecule and its movement through a membrane.

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(2)

A second study was carried out to investigate the effect of passive protein channels on the movement of glucose into cells. The graph below shows the rate of uptake of glucose into erythrocytes by simple diffusion and facilitated diffusion.



(b) Identify the rate of glucose uptake at an external glucose concentration of 4 mmol dm–3 by

(i) simple diffusion; .........................................

(ii) facilitated diffusion. .........................................

(2)

(c) (i) Compare the effect of increasing the external glucose concentration on glucose uptake by facilitated diffusion and by simple diffusion.

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(2)

(ii) Predict, with a reason, the effect on glucose uptake by facilitated diffusion of increasing the external concentration of glucose to 30 mmol dm–3.

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**2.** Osteoporosis is a major health problem for many post-menopausal women. As the ovaries reduce their secretion of estrogen, calcium is gradually lost from bones, weakening them and increasing the chance of fractures. To test whether diet influences the rate of calcium loss, ovaries were removed from groups of female rats and the rats were then either fed a control diet or the same diet with one gram of a supplementary food per day. The rate at which the rats excreted calcium was measured. The ratio of calcium loss between the control rats and the rats that were given a supplementary food was calculated. .

The results are shown in the graph below.



(a) (i) Identify which supplementary food was **most** effective in reducing calcium loss.

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(1)

(ii) Identify which supplementary food was **least** effective in reducing calcium loss.

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(1)

(b) Among the ten foods shown in the graph, seven are plant products (vegetables) and three are animal products. Discuss whether the plant or the animal products were more effective at reducing calcium loss.

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**HL IB Biology I – Data Analysis (Paper 2) Practice #2**  Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**1.** At the start of glycolysis, glucose is phosphorylated to produce glucose 6-phosphate, which is converted into fructose 6-phosphate. A second phosphorylation reaction is then carried out, in which fructose 6-phosphate is converted into fructose 1,6-bisphosphate. This reaction is catalyzed by the enzyme phosphofructokinase. Biochemists measured the enzyme activity of phosphofructokinase (the rate at which it catalyzed the reaction) at different concentrations of fructose 6-phosphate. The enzyme activity was measured with a low concentration of ATP and a high concentration of ATP in the reaction mixture. The graph below shows the results.



(a) (i) Using **only** the data in the above graph, outline the effect of increasing fructose 6-phosphate concentration on the activity of phosphofructokinase, at a low ATP concentration.

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(2)

(ii) Explain how increases in fructose 6-phosphate concentration affect the activity of the enzyme.

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(2)

(b) (i) Outline the effect of increasing the ATP concentration on the activity of phosphofructokinase.

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(2)

(ii) Suggest an advantage to living organisms of the effect of ATP on phosphofructokinase.

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(1)

**2.** The enzyme aspartate carbomyltransferase (ACTase) is a key regulatory enzyme in nucleotide metabolism in bacteria. The activity of this enzyme was studied in the bacterium *Helicobacter* *pylori*, an important human pathogen. ACTase activity and the growth of *H. pylori* were measured at different concentrations of carbomoyl aspartate (CAA), the end product of the reaction catalysed by ACTase.



(a) (i) State the growth of *H. pylori* at a CAA concentration of 30 mmol dm–3.

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(1)

(ii) Calculate the change in ACTase activity between CAA concentrations of 20 and 40 mmol dm–3.

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(1)

(b) Compare the effect of increasing CAA concentration on the growth of *H. pylori* and ACTase activity.

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(2)

(c) Explain the effect of CAA on ACTase activity.

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(2)

(d) Suggest a direct medical application of this information.

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(1)

**HL IB Biology I – Data Analysis (Paper 2) Practice #3 Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**1.** The hydrolysis of inorganic phosphate (PPi) by phosphatase enzyme provides energy for a wide range of reactions. A phosphatase (PPase) occurs bound to thylakoid membranes. This enzyme was purified from the thylakoid membranes of spinach leaves using chromatography. The activity of the membrane bound enzyme and the purified enzyme was measured.

The effect of the concentration of magnesium ions (Mg2+) on the relative activity of these enzymes was determined using different concentrations of magnesium chloride. The concentration of inorganic phosphate used in both cases was of 1 mmol dm–3.

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| --- | --- |
| **Activity of phosphatase (arbitary units)** | |
| *Membrane bound* | *Purified* |
| 12 618 | 1215 |



(a) State the percentage of relative activity of the purified enzyme when the concentration of magnesium chloride is

(i) 1 mmol dm–3 ...................................

(ii) 2 mmol dm–3 ...................................

(2)

(b) Outline the effect of magnesium chloride on the relative activity of the membrane bound enzyme.

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(2)

(c) Calculate the approximate ratio of inorganic phosphate to magnesium chloride concentration needed to achieve maximum activity in membrane bound enzymes.

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(1)

(d) (i) State the difference in phosphatase activity when membrane bound and when purified.

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(1)

(ii) Suggest a reason for this difference.

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(1)

**2.** A study was conducted on how cattle grazing affects the water content of soils. One area studied was a pasture of alfalfa (*Medicago sativa*). A special probe was used to take measurements of soil water to depths of 300 mm. The range of measurements obtained were used to calculate the total soil water content expressed in mm. Results from part of the study during the growing season for the year 2000 are shown below.



(a) State the overall trend in total soil water content during the study period.

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(1)

(b) Identify the day on which the difference in total soil water content of grazed and un-grazed areas was greatest.

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(1)

(c) Discuss the effects of grazing on the total soil water content.

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**HL IB Biology I – Data Analysis (Paper 2) Practice #4 Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**1.** Inflammation of human tissues often causes pain. Cyclooxygenases (COX) are a group of enzymes that play a role in causing inflammation. Analgesics are drugs that can reduce pain. The graph below shows how increasing concentrations of the analgesic drug dipyrone, affects the activity of three different cyclooxygenases, COX-1, COX-2 and COX-3.



(a) Outline the relationship between dipyrone concentration and COX-3 activity.

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(2)

(b) Deduce whether dipyrone is an inhibitor of COX-2.

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(2)

(c) Evaluate the potential of dipyrone as an analgesic using the data in the graph.

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**2.** The symptoms of asthma vary according to the time of year. A study was carried out in New York to determine if an increase in the amount of pollen in the air caused an increase in the number of asthma attacks. Over a period of 270 days, the number of people admitted to New York hospitals with asthma attacks was recorded. The graph below shows this data together with the pollen count.



(a) Identify the greatest number of hospital admissions in one day.

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(1)

(b) Describe how the numbers of hospital admissions changed over the period of study.

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(3)

(c) Evaluate whether the hypothesis that pollen in the air increases asthma attacks is supported by the data.

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(2)

(d) State **one** effect of asthma on the gaseous exchange system.

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(1)

**HL IB Biology I – Data Analysis (Paper 2) Practice #5 Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**1.** A recent study of evolutionary aspects of the human diet considered the intake of ascorbic acid and fat. Fat can be classified as saturated, monounsaturated and polyunsaturated. The graph below is based on data from three periods of time: hunter-gatherer, agricultural and industrialized.



(a) Compare the changes in the intake of saturated fat with polyunsaturated fat among hunter-gatherer, agricultural and industrial populations over the whole time span.

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(2)

(b) The graph above does not include the third source of fat, monounsaturated fat. Using the given data, estimate the percentage of energy from monounsaturated fat in the diet of the earliest hunter-gatherers.

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(1)

(c) Besides fat, state **one** other group of compounds which supplies energy in the diet.

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(1)

(d) Suggest a reason for the change in the intake of

(i) ascorbic acid in industrialized populations.

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(1)

(ii) saturated fats in industrialized populations.

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(1)

**2.** A major requirement of the body is to eliminate carbon dioxide (CO2). In the body, carbon dioxide exists in three forms: dissolved CO2, bound as the bicarbonate ion, and bound to proteins (eg hemoglobin in red blood cells or plasma proteins). The relative contribution of each of these forms to overall CO2 transport varies considerably depending on activity, as shown in the table below.

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| **CO2 Transport in Blood Plasma at Rest and During Exercise** | | | |
|  |  | **Rest** | **Exercise** |
| **Form of transport** | Arterial | Venous | Venous |
|  | mmol l–1 blood | mmol l–1 blood | mmol l–1 blood |
| dissolved CO2 | 0.68 | 0.78 | 1.32 |
| bicarbonate ion | 13.52 | 14.51 | 14.66 |
| CO2 bound to protein | 0.3 | 0.3 | 0.24 |
| Total CO2 in plasma | 14.50 | 15.59 | 16.22 |
| pH of blood | 7.4 | 7.37 | 7.14 |

(a) Calculate the percentage of CO2 found as bicarbonate ions in the plasma of venous blood at rest.

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(1)

(b) (i) Compare the changes in total CO2 content in the venous plasma due to exercise.

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(1)

(ii) Identify which form of CO2 transport shows the greatest increase due to exercise.

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(1)

(c) Explain the pH differences shown in the data.

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