2024 YEAR 4 EXPRESS BIOLOGY PRELIMINARY EXAMINATION

Paper 3: Practical (40 marks)

1 (a)(i) 25.00 [1]

(ii) [4]

- Required columns for table:
  (percentage) concentration of celery extract,
  time taken for the paper disc to reach the surface /s for two repeats /trials,
  mean time taken /s
- Correctly labelled headings and units for the columns that are present,
- Records the mean results to the nearest whole number
- Expected trend: time taken for the paper disc to reach the surface is shortest for the highest concentration of celery extract (100%) and increases as the concentration of celery extract decreases.

(b)(i) **Both correct for 1 mark** [1]

*independent variable: (*percentage) concentration of catalase /celery extract

dependent variable: time taken for the paper disc to reach the surface of H_2O_2

(ii) The higher the concentration of celery extract /catalase, the quicker the paper disc rises to the surface [1]
(Explanation: Hydrogen peroxide is broken down to oxygen and water quicker/ more enzyme-substrate complexes formed and hence oxygen production is faster.)

(iii) **2 marks for control + correct explanation** [2]

Control	Explanation
Use same volume of distilled water to replace celery extract OR Use boiled celery extract instead	This is to show that results are due to the presence of enzymes (catalase) in celery, which is necessary to catalyse the reaction /to produce oxygen that causes the paper disc to reach the surface of the hydrogen peroxide solution.
Use same volume of distilled water instead of hydrogen peroxide solution	Enzymes (catalase) are specific in action. Hydrogen peroxide is the specific substrate that can fit into the active site of catalase molecules to be broken down / catalysed by catalase. If distilled water is used, the paper discs will not float to the surface.

(c)(i) measure the height /distance of the hydrogen peroxide; [2]
divided by time taken

(ii) **1 mark for one source of error + effect on results**

Source of Error	Effect on results
The reaction began immediately after hydrogen peroxide was poured into the test tube but the stopwatch was only started after the marked level was reached.	The time recorded for the paper disc to reach the surface of hydrogen peroxide solution will be less than expected.
Difficult to ascertain/ judge when the paper disc reaches the top of the solution	The time recorded for the paper disc to reach the surface of hydrogen peroxide solution will be shorter or longer than expected.
Paper discs stick to the test tube /not floating up to the surface	

Accept any other plausible SOE + effect
Reject: lack of repeats as a source of error as there were two trials done for each concentration of catalase

(d) *Any 5 of the below* [5]

- Independent variable: indicate at least five different sodium chloride concentrations
- Dependent variable: time taken for the paper disc to reach the surface of the hydrogen peroxide solution
- At least two controlled / constant variables and how they can be controlled, e.g.
  - same volume /concentration of celery extract (catalase) should be used for all the test tubes
  - same volume /concentration of hydrogen peroxide solution should be used for all test tubes
  - same volume of sodium chloride solutions
  - same pH buffer /solution
  - same temperature (using thermostatically-controlled water baths)

- Brief description of procedure:
  1. how the independent variable will be set up, e.g. there should be at least five NaCl concentrations, each NaCl concentration (a fixed volume) to be added to a test tube of celery extract and mixed thoroughly, paper discs to be immersed in each mixture
  2. how the dependent variable would be measured, e.g. time taken for the paper disc to rise to the surface of H_2O_2 solution
  3. describe the setting up of a control, using the original celery extract without any NaCl added.

- State that the experiment is repeated (at least twice) to calculate mean results for data reliability.
- State how the results can be interpreted, e.g. the longer the time taken for the paper disc to rise to the surface (or the paper discs do not rise), the more significant the effect of sodium chloride on the activity of catalase /AW

[Total:18]

2 (a)(i) 20 – 22 mm [1]

(ii) correct calculation [1]

(b)(i)
- Correct scale to occupy at least 70% of both axes
- Correct labels + units for each axis, i.e., y-axis: mean diameter of clear area /mm, x-axis: antibiotic
- Correctly plotted points
- All bars ruled and of equal width + gaps between bars must be of equal width

[4]

(ii)	S	[1]
(c)	Antibiotic Q /6mm measurement for petri dish 2 exclude the value from the mean calculation /repeat experiment	[2] [Total: 9]
3 (a)	*Size:* occupies more than half of the space available *Lines:* clear continuous line with no shading *Accuracy:* detail 1 – only collecting duct and loop of Henle drawn touching + correct orientation detail 2 – shape of both are oval detail 3 – 2 nuclei in loop of Henle + multiple nuclei (number of nuclei need not be accurate) for collecting duct *Proportion:* collecting duct larger in size than loop of Henle	[4]
(b)(i)	line drawn between **K** and **L** + correct measurement: 27 – 29 mm	[1]
(ii)	Correct working: (27 – 29 mm) ÷ 450 actual diameter = 0.060 mm (2 s.f)	[2]
(iii)	measure multiple (at least two) readings for diameter across different positions calculate average length and use this value in calculation	[2]
(c)	**2 marks for each structure feature + correct explanation** • microvilli • + increase surface area to volume ratio for faster rate of absorption (of water /glucose/ amino acids) • numerous mitochondria • + increased rate of aerobic respiration to release more energy for active transport	[4] [Total: 13]