H

NATIONAL JUNIOR COLLEGE, SINGAPORE
Senior High 2
Practical Examination
Higher 2

CANDIDATE NAME			
BIOLOGY CLASS	2bi2_____	REGISTRATION NUMBER	

Biology

9744/04

Paper 4 Practical

22 August 2019

2 hours 30 min

Additional Materials: Answer Booklet

READ THESE INSTRUCTIONS FIRST

Write your name, Biology class and registration number on all the work you hand in.
Circle your practical shift and laboratory in the boxes provided.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Answer questions one and two in the spaces provided on the Question Paper.
Answer question three on the Answer Booklet provided.

The use of an approved scientific calculator is expected, where appropriate.
You may lose marks if you do not show your workings or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in the brackets [ ] at the end of each question or part of question.

Shift		
1	2	3
Laboratory		
BI23	BI24	CM44

For Examiner's Use	
1	**20**
2	**20**
3	**15**
Total	**55**

This document consists of 16 printed pages.

1 In humans, kidneys are the organs that remove waste products from the blood and produce urine. Small, useful molecules such as glucose are also removed from the blood in the kidney. Glucose must be reabsorbed into the blood so that very little is lost in the urine.

The concentration of glucose in urine can be estimated in order to check that the kidneys are working.

You will not be testing real urine. You will be testing solutions that represent urine and will be referred to as "mock urine".

You are required to test each of three samples of mock urine for the presence of glucose. These represent samples taken at different times from the same person.

You are provided with:

labelled	contents	hazard	Volume / cm^3
U1	mock urine	none	20
U2	mock urine	none	20
U3	mock urine	none	20
Benedict's	Benedict's solution	none	20
G	2% glucose solution	none	20
W	distilled water	none	20

If **Benedict's** comes into contact with your skin, wash off immediately under running water. It is recommended that you wear suitable eye protection.

Read step 1 to step 7 before proceeding.

Proceed as follows:

1. Set up a water-bath and heat to boiling for use in step 6.

2. Put 2 cm^3 of **U1** into a test-tube.

3. Put 2cm^3 of Benedict's solution into the same test-tube.

4. Shake the test-tube gently to mix contents.

5. Repeat step 2 and step 4 for **U2** and **U3**.

6. Put all three test-tubes into the water-bath you prepared in step 1 and immediately start timing.

7. Record in **(a)(i)** the time taken to the first colour change for each tube **and** record the final colour at 90s. After 90s, remove each of the test-tubes from the water-bath. If there has been no colour change during the 90s, record the time to the first colour change as "more than 90". You should still record the final colour at 90s.

(a) (i) Record your results in an appropriate table.

[4]

(ii) Use your results in **(a)(i)** to state which of **U1**, **U2**, and **U3**, do **not** contain glucose.

……..... [1]

(iii) State how you will use your results in **(a)(i)** to identify which of **U1**, **U2**, and **U3**, has the highest concentration of glucose.

……..... [1]

(iv) State which of **U1**, **U2**, and **U3** has the highest concentration of glucose.

……..... [1]

If the sample with the highest concentration of glucose is more than 0.5%, then this may mean that a kidney is not working.
You are required to estimate the concentration of glucose in the sample stated in **(a)(iv)** by :

- Preparing 10 cm^3 of a 0.5% glucose solution
- Carrying out a Benedict's test on the 0.5% glucose solution
- Using your results to estimate the concentration of glucose in the sample stated in **(a)(iv)**.

(v) You are provided with a 2% glucose solution, **G**.
Complete Table 1.1 to describe how **G** could be diluted to produce 10 cm^3 of a 0.5% glucose solution.

Table 1.1

final percentage concentration of glucose	volume of 2% glucose solution / cm^3	volume of distilled water, W / cm^3
0.5		

[1]

(vi) State one variable that must be standardized when carrying out the Benedict's test, to allow you to make a valid comparison between the results collected in **(a)(i)** and the result you will collect for the 0.5% glucose solution that you have prepared.

……..... [1]

8. Prepare the 0.5% glucose solution as shown in Table 1.1 in the sample tube provided.
9. Repeat the Benedict's test with the 0.5% glucose solution and the sample stated in **(a)(iv)**.
10. Record in **(a)(vii)** the time taken to the first colour change. After 90s, remove the test-tubes from the water-bath.
    If there has been no colour change during the 90s record the time to the first colour change as 'more than 90'.

(vii) Record your results in an appropriate table.

[2]

(viii) Use your results from **(a)(vii)** to complete Table 1.2 by using **one** tick (✓) to show your estimate of the concentration of glucose in the sample stated in **(a)(iv)**.

Table 1.2

percentage concentration of glucose in mock urine sample/%	estimate tick (✓)
below 0.5	
0.5	
above 0.5	

[1]

(ix) This procedure enabled you to estimate the concentration of glucose in the mock urine sample.

Suggest how you would improve this procedure to find a more accurate estimate of this concentration.

……...

……...

……..

……....

……..... [3]

(b) (i) Fig. 1.1 is a photomicrograph of a stained transverse section through an animal organ. This organ is used to transport urine from the kidney to the bladder.

Fig. 1.1

You are not expected to be familiar with this specimen.

Use a sharp pencil for drawing.

Draw a large plan diagram of **half** of the organ in Fig. 1.1, shown by the shaded area in Fig. 1.2.

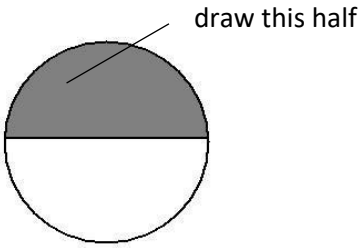


Fig. 1.2

You are expected to draw the correct shape and proportions of the different tissues.

[3]

(ii) You are provided with a sample slide of a bladder wall showing the transitional epithelium. Fig. 1.3 shows the position of the transitional epithelium.

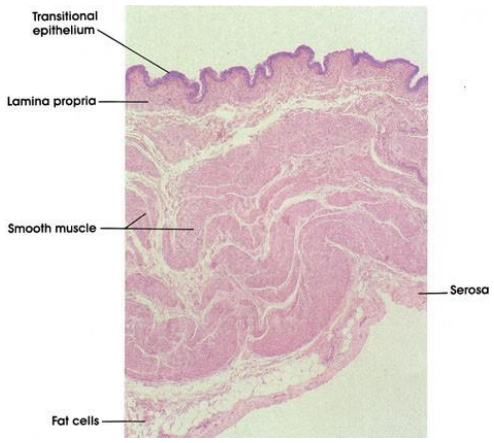


Fig. 1.3

Determine the thickness of the transitional epithelium at high power.

Show your working.

You are not expected to be familiar with this specimen.

[2]

[Total: 20]

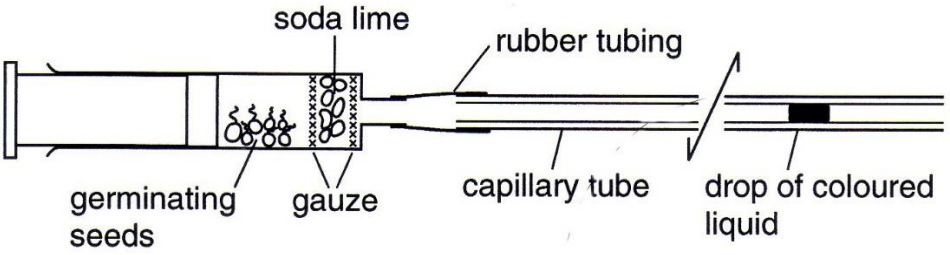
Question 2 starts on page 10

2 You are going to investigate the respiration rate in a particular seedling species and relate this to the age of the seedling.

In this experiment the respiration rate of seedlings can be monitored by the rate of absorption of oxygen, carbon dioxide is absorbed by soda lime within the apparatus.

Take care. Do not remove the soda lime from the syringe as it is corrosive and will burn your skin.

Diagram:



1. Remove the plunger from the syringe.
2. Take 3 two-day old seedling, carefully remove and discard its seed coat.
3. Introduce the two-day old seedlings into the syringe between the soda lime and the plunger.
4. Connect the capillary tube to the syringe via the rubber connecting tube.
5. Holding up the whole apparatus, dip the free end of the capillary tube into the vial of coloured water such that a small drop of coloured water is introduced into the end of the capillary tube. (There is no need to pull the plunger of syringe)
6. Wipe excess colored water from outer surface of the capillary tube. The size of the drop of coloured water in the capillary tube is not important as long as it can be seen clearly.
7. Place the respirometer horizontally on the separate piece of graph paper which you have been provided.
8. Leave the seedlings alone for 1 minutes for it to acclimatize to the environment.
9. Adjust the drop of coloured water to the start of the scale (by moving the strip of graph paper)
10. Start a stop watch.
11. Measure the movement of the drop of colored water for 3 minutes.
12. Immediately after you have recorded your results, detach the syringe from the capillary tube by pulling gently from the rubber connecting tube. Using an empty 5 cm^3 syringe, pump air through the capillary tube to push out all the coloured water within the capillary tube onto a piece of filter or blotting paper (do not use water to flush the capillary tube).
13. Repeat step 1 to 12 with another set of seedlings of the same age-group.
14. Repeat the experiments with one-day old seedlings.

15. Use the space below to record in standard units of measurement, your results.

[5]

16. Weigh each of the set of seedlings that were used and record their masses.

[2]

17. Using your data from step 15 and 16, account for the trends observed.

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……

…… [4]

18. Predict the trend of results, should the experiment be carried out for three-day old seedlings and five-day old seedlings. Explain your predictions. (At five days, seedlings usually start to sprout small leaves)

Three-day old seedlings:

……

……

…… [2]

Five-day old seedlings:

……

……

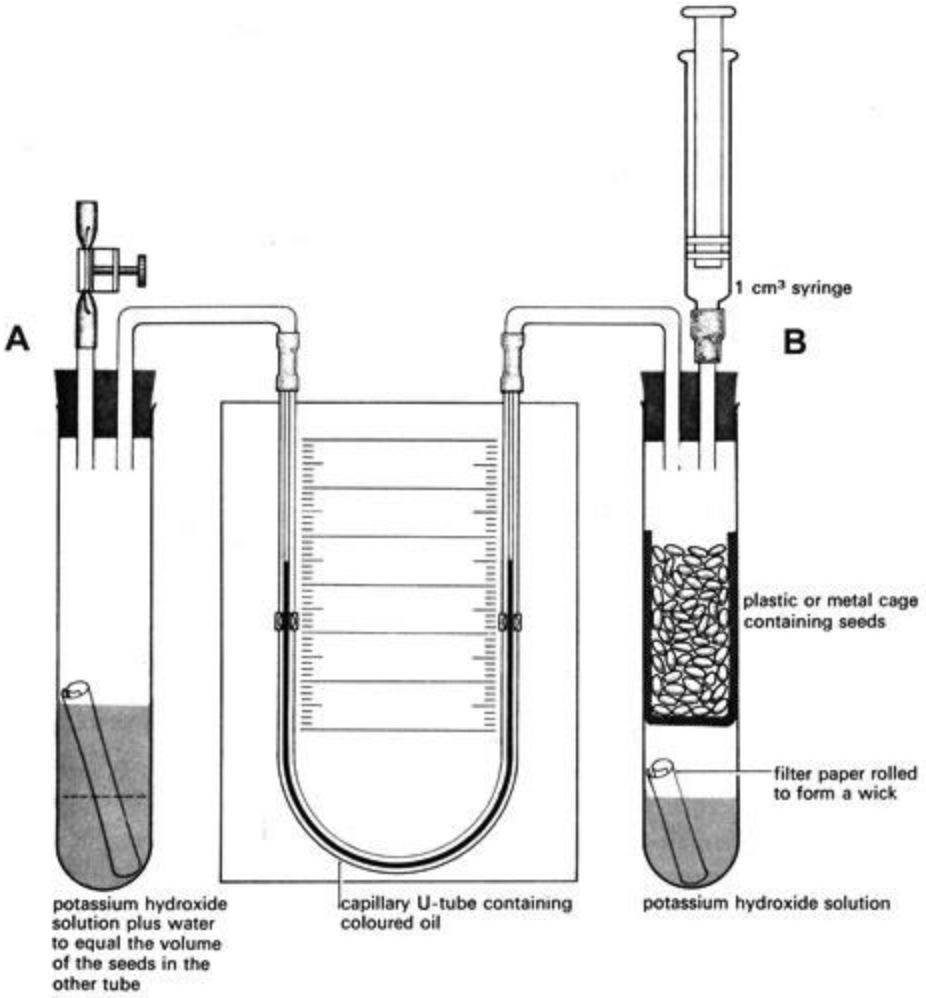
…… [2]

19. Identify one source of error in the procedure.

……

…… [1]

20. A more complex apparatus for measuring respiration is shown below. Glass beads of same mass as the seedlings are added into a metal cage in setup A, before the start of the experiment.



Explain two ways in which this apparatus is significantly more accurate than the one used in this experiment.

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…… [4]

[Total: 20]

Question 3 starts on page 15

3 The Java Rhino is one of the rarest animals in the world. It is estimated that only 60 of them are known to exist.

A few of them have been successfully bred in captivity and released in a wildlife sanctuary in Sumatra.

A baby Java Rhino has been found smuggled in one of the shipping containers by the customs officers. Plan an investigation to verify if the Java Rhino was one that was bred in captivity and released to the Sumatran wildlife sanctuary or poached from the wild.

Your planning must be based on the assumption that you have been provided with the following equipment and materials.

- tissue samples (epidermal) from the Java Rhino provided by the customs and a known Java Rhino from the wildlife sanctuary in Sumatra.
- pestle and mortar
- DNA extraction buffer solution
- glass rods
- microcentrifudge tubes
- restriction enzyme
- agarose gel plate
- suitable source of electrical current
- radioactive probe
- nitrocellulose membrane
- autoradiography equipment.

Your plan should have a clear and helpful structure to include

- an explanation of the theory to support your practical procedure
- a description of the method used, including the scientific reasoning behind the method
- the type of data generated by the experiment
- how the results will be analysed including how the origin of the organism can be determined.

[Total: 15]

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