



OUNDLE

School

2015 Academic Scholarship

Science

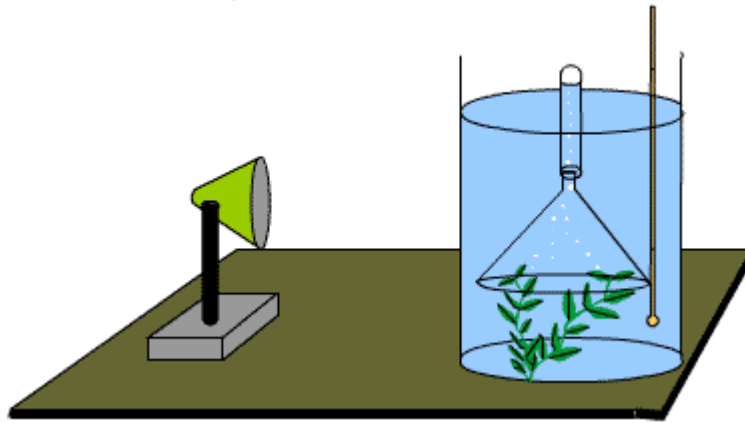
Theory Paper

Time Allowed: **1 hour**

Name:

Biology Section

1. Some sprigs of a water plant *Elodea* were placed in the apparatus as shown. The light was about 0.5m away and the gas given off was collected.



- a. If the lamp were moved closer, to 0.25m away, what would you expect to happen to the volume of gas collected?

.....
(1)

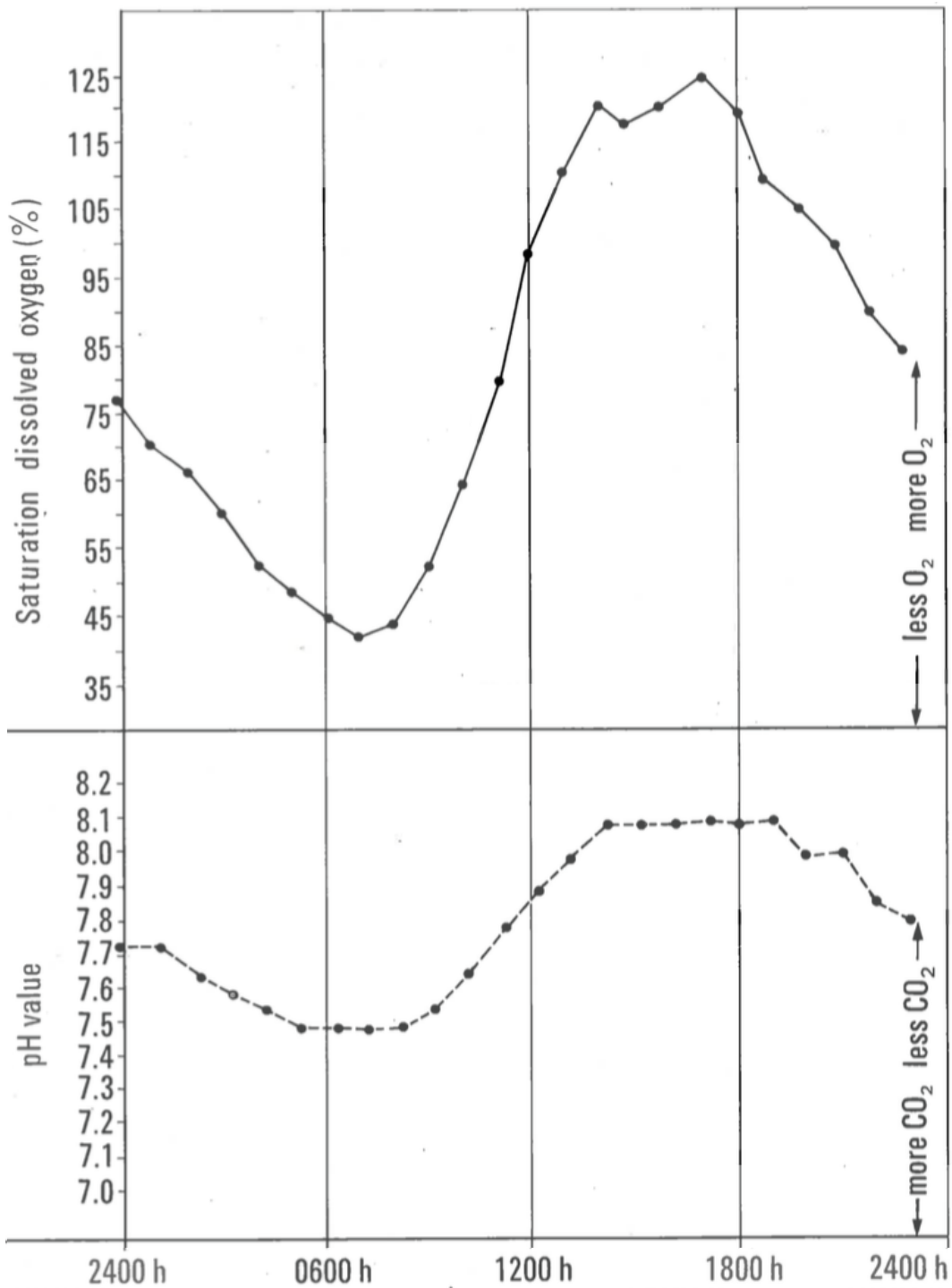
- b. What exactly could you conclude about light intensity and the production of gas?

.....
.....
(2)

- c. How would you show that the gas was oxygen?

.....
(1)

The graphs below show changes in the saturation of dissolved oxygen and pH of water in a river during 24hrs.



d. Describe the changes in pH and oxygen saturation.

.....

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.....

(2)

e. How can you explain these changes in the pH and oxygen saturation of the water?

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.....

(2)

f. What additional mineral element is needed to make chlorophyll?

.....

(1)

g. When do plants respire?

.....

(1)

[Total 10 marks]

2. Mitochondria, chloroplasts and the nucleus are all very important components of plant cells.

Select two and make a case for each of them being the most important part of the cell.

Component:

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(5)

Component:

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(5)

[Total 10 marks]
[Biology section total 20 marks]

Chemistry Section

3. A pupil carries out a number of reactions to try to establish the order of reactivity of three metallic elements, A, B and C. Samples of the elements are not available, but their oxides are available as powdered solids.

First, he heats the oxides separately with powdered charcoal. A does not react, but both B and C change colour and emit a colourless gas. The gas turns limewater milky.

a. Of which non-metallic element does charcoal consist?

.....
(1)

b. What can he conclude about the relative reactivity of element B and charcoal?

.....
(1)

c. Which substance is formed as a milky precipitate in the limewater?

.....
(1)

d. What could he do to demonstrate that the oxides of B and C had been converted to the metals? State the expected result of the test.

.....
.....
.....
.....
.....
(2)

Second, he passes hydrogen gas over heated samples of each oxide. Again, the oxide of A does not react, but the oxides of B and C are reduced to their respective metals.

e. What is meant by the word *reduction* in a chemical sense?

.....
.....
(1)

f. Which other substance is produced in the reactions of the oxides of B and C?

.....
(1)

Finally, samples of the oxides of B and C are heated. B does not react but C decomposes to give a colourless gas which relights a glowing splint.

g. Which of the elements B and C must be the least reactive? Why?

.....
.....
(2)

h. List the three elements in order of decreasing reactivity.

Most reactive:
.....

Least reactive:

(1)

[Total 10 marks]

4. Three test tubes are known to contain magnesium powder, sodium, and copper respectively, but they have all lost their labels. A pupil is given the job of confirming their identities by a series of chemical tests.

First, samples are heated in air.

- a. What would be expected to happen to the sample of magnesium powder? Describe what you would see, and state the colour of the solid residue.

.....
.....
(2)

- b. What would you expect the sample of copper to do?

.....
(1)

Secondly, the pupil added samples separately to some cold water.

- c. Which element would you expect to react the most vigorously? Write a word equation for the reaction.

.....
.....
.....
.....
(3)

- d. In the above reaction, describe how you could show that an alkaline solution had been formed. State which substance you would add, and what you would see.

.....
.....
.....
(2)

e. Copper is a very malleable metal. What does this mean?

.....

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(1)

f. Incorporating your answers from previous questions give a suitable use for copper in everyday day life that makes use of its malleability.

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(1)

[Total 10 marks]

[Chemistry section total 20 marks]

Physics Section

5. This is a question about the forces acting on a ball whilst it is moving through the air after it has been launched.

The mass of the ball is 10kg

Take acceleration due to gravity $g = 10\text{N/kg}$

- a. The ball is first projected straight up at 50m/s. Once it has left the launcher it is in free-flight.

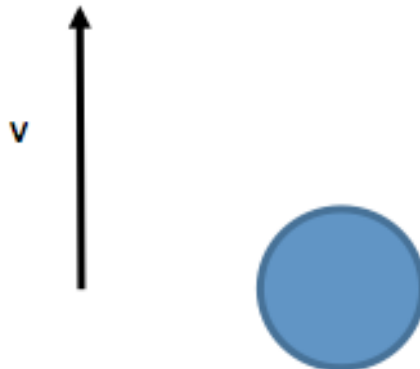
What two forces (A and B) act on the ball?

Force A:

Force B:

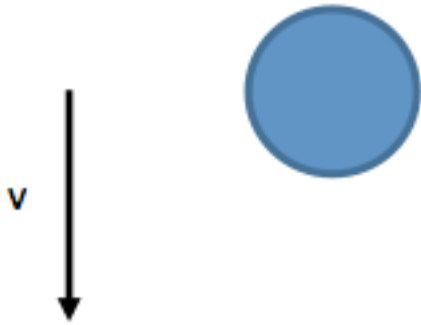
(2)

- b. The diagram below shows the ball moving up. Show the positions and directions of forces A and B acting on the ball.



(2)

- c. The diagram below shows the ball moving down. Show the positions and directions of forces A and B acting on the ball.



(2)

- d. Calculate the weight of the ball.

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.....

(2)

- e. The air resistance, or drag D , varies with the speed of the ball:

V (m/s)	0	10	20	30	40	50
D (N)	0	2	7	16	27	32

- i. Complete the table below with the values of the total (resultant or unbalanced) force F acting on the ball as it rises:

V (m/s)	50	40	30	20	10	0
F (N)						

(2)

ii. Complete the table below with the values of the total (resultant or unbalanced) force F acting on the ball as it falls:

V (m/s)	0	10	20	30	40	50
F (N)						

(2)

f. If there is no air resistance the ball takes as much time to go to the top of its path as it does to come down. Explain why you think this is the case?

.....
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.....
.....

(2)

g. When there is air resistance do you think it takes more, less or the same time to go up as it comes down. Justify your answer.

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(3)

[Total 17 marks]

[Physics section total 17 marks]

End of Paper