

Name and School:



OUNDLÉ

School

2015 Academic Scholarship
Preliminary Examination

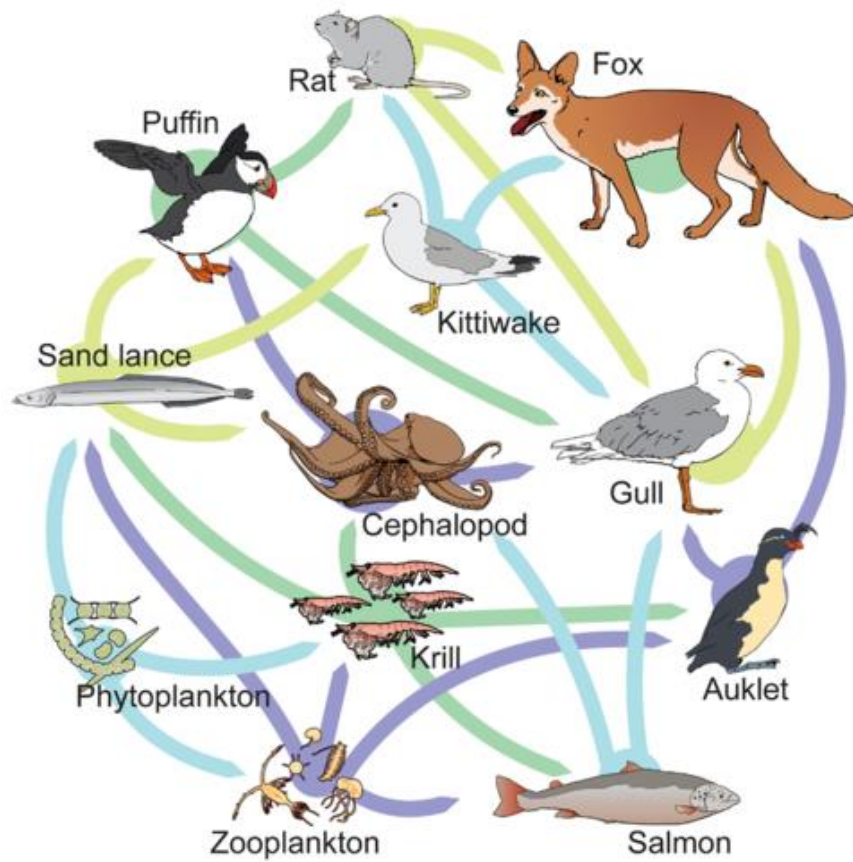
Science

Time Allowed : One Hour

- Write your name on the question paper
- Write all your answers on the question paper
- Calculators are allowed

Biology Section

1. The diagram below shows a food web.



- a. Use the information provided in the food web above. Draw a food chain containing four stages in the space below.

b. On your previous diagram, label the producer and one secondary consumer in this system. (2)

c. What is the source of energy for the phytoplankton?
..... (1)

d. Can you give an example of a carnivore and an herbivore from the original food web?
.....
..... (2)

The population of krill, a tiny crustacean, is in danger from the growing demand for health supplements and food for fish farms

e. Suggest what may happen to other species in the web if the krill are removed by overfishing.
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..... (3)

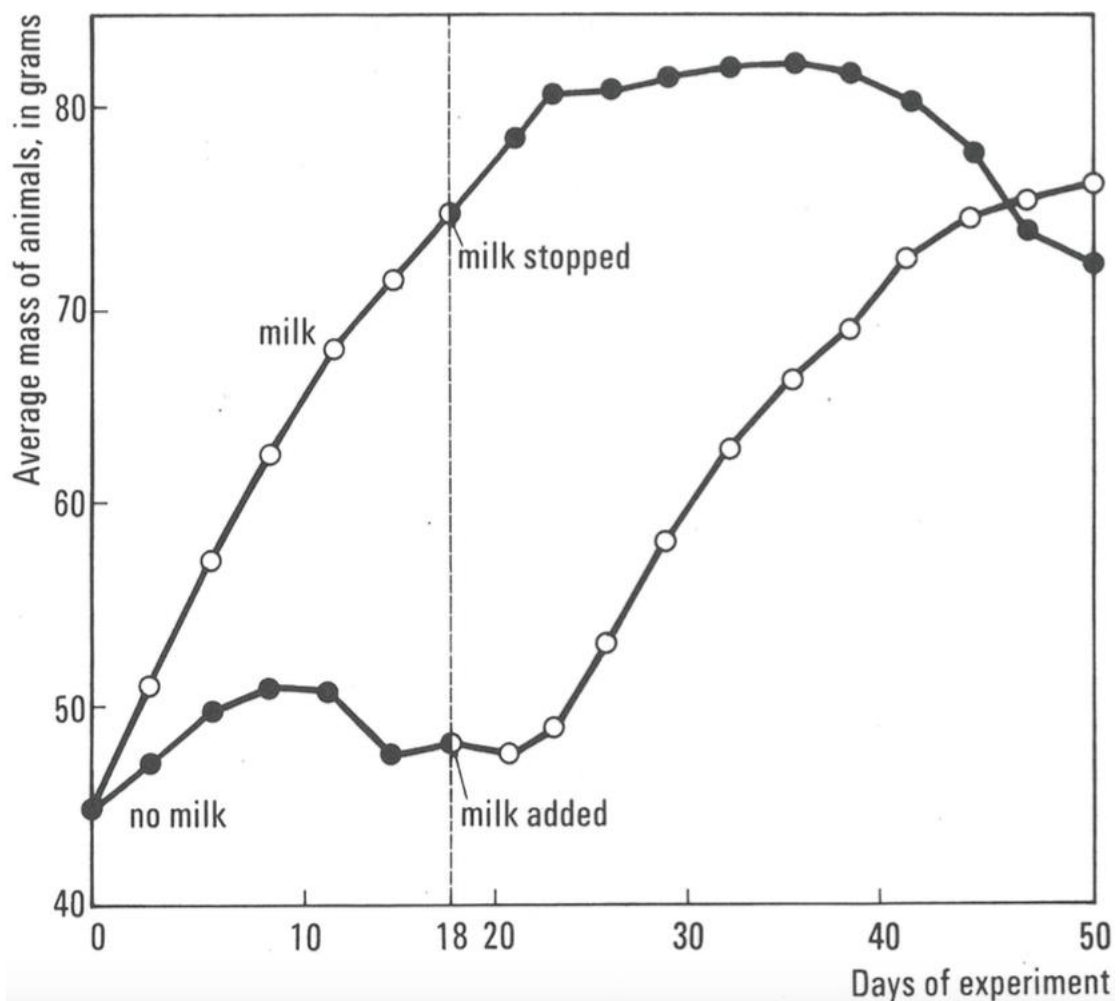
[Total 10 marks]

2. The idea that a disease could be caused by a lack of an essential substance in food occurred to a few people in the past but few tried to do carefully controlled experiments to test their ideas.

One scientist, Magendie, fed dogs a diet of sugar, butter, gelatine (a protein), and distilled water. The dogs all died within 30 to 36 days.

Frederick Hopkins fed rats on purified milk protein, starch, sugar, lard, and salts. The rats did not grow and soon died but adding 3cm³ of milk to the diet caused the rats to grow normally.

The results of one of his experiments are shown below.



Frederick Hopkins' experiment on feeding milk to rats.

- a. What does Frederick Hopkins' experiment on rats tell us that the experiment on dogs did not?

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b. Suggest one other way in which the rat experiment is better than the dog experiment?

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(1)

c. Can you suggest a reason why the young rats without milk grew a little during the first few days of the experiment?

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(2)

d. Hopkins studied the average mass of the rats, suggest two other measurements or observations that might be taken as a record of normal growth?

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.....
(2)

e. Why do you think Hopkins chose mass?

.....

.....
(2)

f. What name do we now use for these essential dietary components?

.....

(1)

- g. Give the name of any deficiency disease caused by the lack of one of these essential dietary components.

.....
(1)

[Total 10 marks]

[Biology Total 20 marks]

Chemistry Section

3. Cobalt carbonate is a red solid with the following properties:
- When heated over a Bunsen burner it turns into a black solid and gives off a colourless gas.
 - The colourless gas turns limewater milky and will extinguish a burning splint or candle.
 - The black solid formed upon heating dissolves in warm hydrochloric acid to form a red solution.
 - If the red solution is carefully evaporated to dryness it produces red crystals.
 - When some of the red crystals are heated, they give off a colourless gas which can be condensed to a colourless liquid. In this event, the red crystals turn blue.
 - If some water is added to the blue crystals, they turn red (or pink) again.
- a. Draw a fully labelled diagram of the apparatus you could use to heat the Cobalt carbonate and to pass the gas produced through limewater.

It may be drawn freehand.

b. Identify the gas given off when heating cobalt carbonate. State its name and chemical formula.

.....
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(2)

c. Using only the information given in the question, suggest one way in which the gas identified in the previous question could be used.

.....
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(1)

d. What is the name of the black solid produced by heating the cobalt carbonate?

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(1)

e. Assuming that cobalt has similar reactivity to copper. Describe in a one method by which you could convert the black solid to the metallic element, cobalt.

You should include any chemicals used, the reaction conditions, and give the word equation for the reaction.

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(4)

- f. What test could you use to show that a metallic element had been produced? State the positive result of the test.

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(2)

- g. Write a word equation for the reaction of the black solid with hydrochloric acid. Include state symbols.

(3)

- h. How would you show that the colourless liquid produced when heating the red crystals was pure water?

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.....

(2)

- i. What do you think would be a possible use for the blue crystals produced from heating the red crystals?

.....

(1)

- j. The chemical formula for cobalt sulphate is CoSO_4 . If the formula and charge on the sulphate ion are SO_4^{2-} , what symbol represents the formula and charge for the cobalt ion?

.....

(1)

[Total 21 marks]

[Chemistry Total 21 marks]

Physics Section

4. Kalpana finds a small stone. To help identify the type of stone, Kalpana decides to find its density.

Kalpana explains why she thinks this will help.



The density will be the same, whatever the size of the stone, as long as the type of rock is the same.

Her friend, Christine, disagrees.



Bigger stones will have a higher density because they are heavier.

- a. Circle who you think is correct.

Kalpana

Christine

Explain your answer.

.....

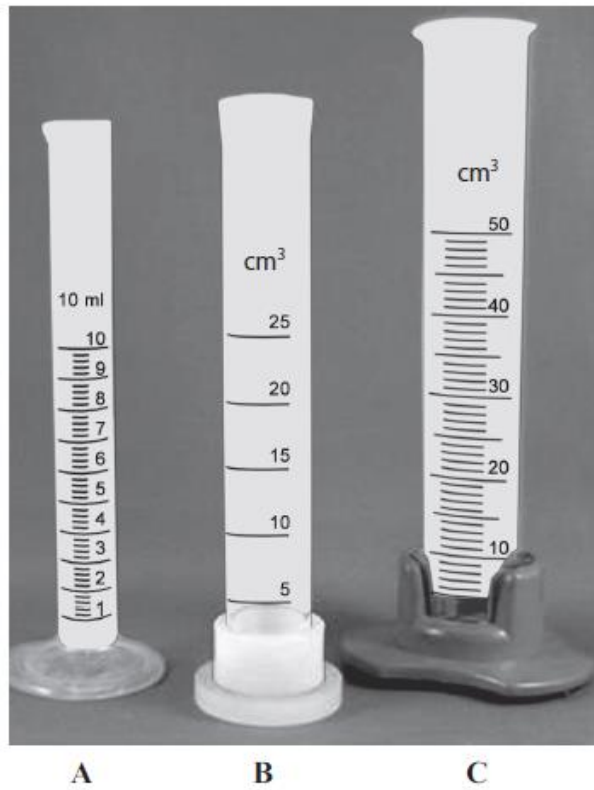
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- b. Kalpana uses a measuring cylinder to find the volume of water displaced by the stone.

She has the three measuring cylinders below to choose from.



- i. Which measuring cylinder (A, B or C) would give the most precise measurement? Explain your answer.

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

(2)

- ii. The most precise measuring cylinder may not give the most accurate reading. Suggest why this is the case.

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.....

(1)

c. The table shows the measurement that Kalpana makes.

Mass of stone (g)	Volume of stone (cm ³)
54	23

i. State the equation linking density, mass, and volume.

(1)

ii. Calculate the density of the stone.

State your answer to an appropriate number of significant figures and give the appropriate unit.

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(3)

d. Kaplana can use her value of density to identify the type of stone.

i. Suggest how she might do this?

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(2)

ii. Kalpana may still be unsure about the type of stone.

Suggest why?

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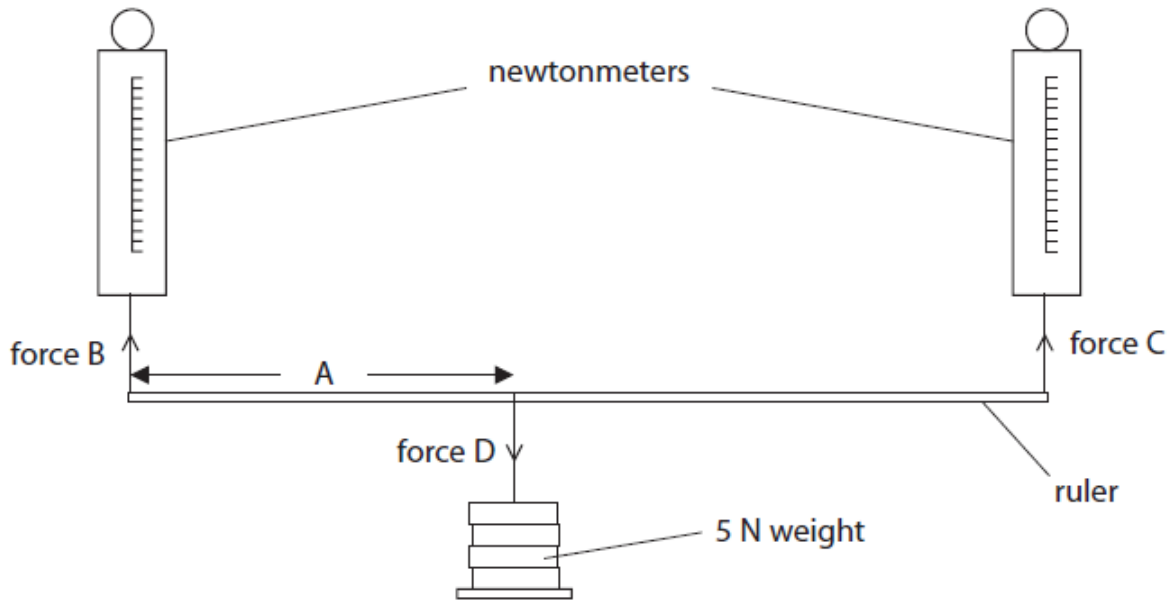
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(1)

[Total 12 marks]

5. A student investigates the vertical forces acting on the ends of a horizontal ruler when it supports a load.

The ruler hangs from two newtonmeters with a weight suspended from it as shown below.



- a. The student moves the weight along the ruler and records forces B and C by taking reading from the newtonmeters.

i. Which is the independent variable in this investigation?

.....
.....

(1)

ii. Name a control variable from this investigation?

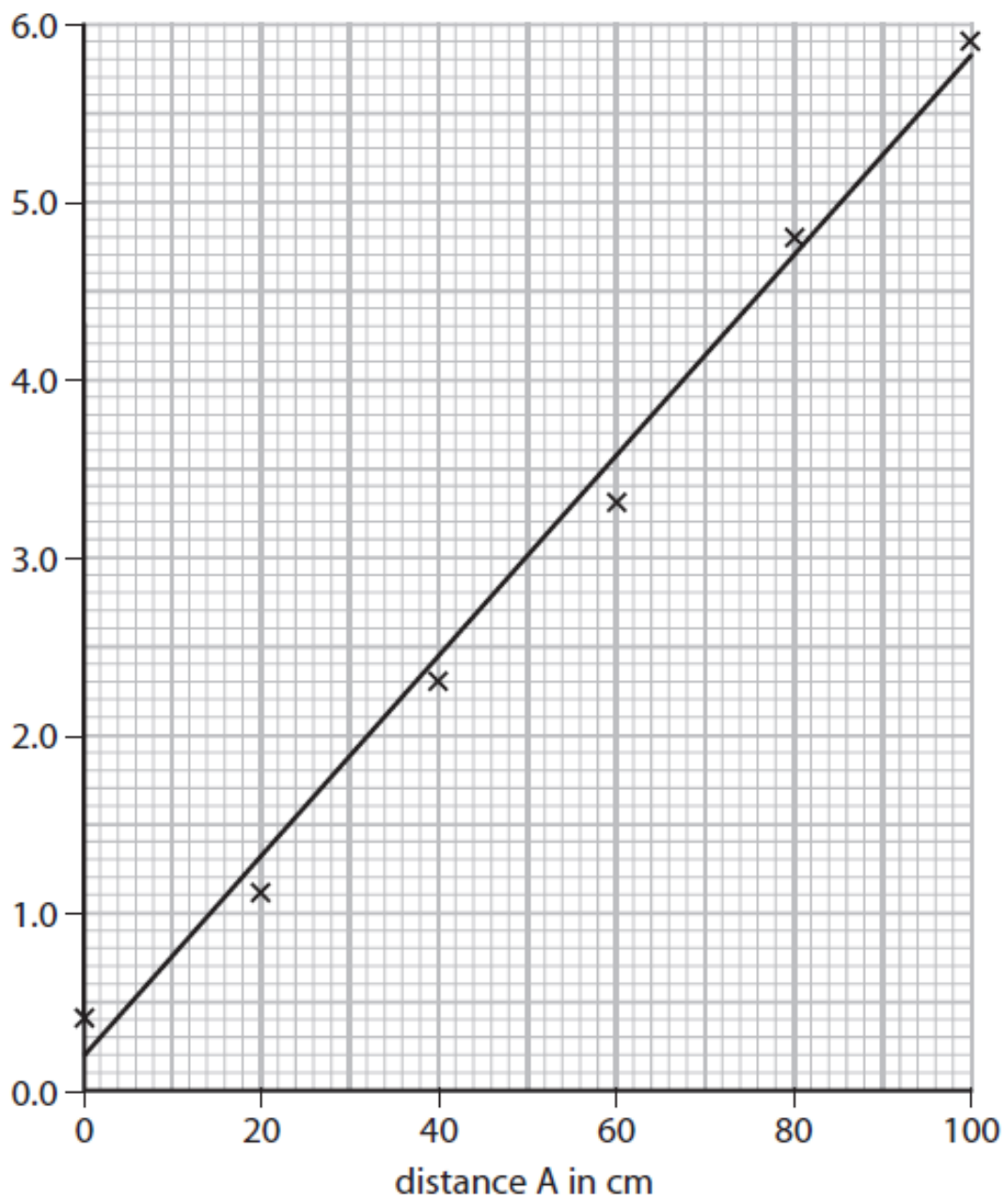
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(1)

The student records these readings.

Distance A (cm)	Reading from newtonmeter of force B (N)	Reading from newtonmeter of force C (N)
0	5.1	0.4
20	4.0	1.1
40	2.9	2.3
60	2.0	3.3
80	1.1	4.8
100	0.2	5.9

b. She plots this graph to show how the force C changes with distance A.



i. State exactly what should be added to the above graph to complete it?

.....

.....

(1)

ii. Using the above grid and axes, plot a second line to show how force B varies with distance A.

(3)

iii. Use the lines on the graph to find the distance A for which force B and force C are equal.

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(1)

c. Suggest why neither force B nor force C are ever zero during the investigation.

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(1)

[Total 8 marks]

[Physics Total 20 marks]

End of Paper