SEVENOAKS SCHOOL

YEAR 9 (13+) SCHOLARSHIP

May 2024
for entry in September 2024

SCIENCE 1

Your Name: _____

Your School: _____

Time allowed: 1 hour

Equipment needed: Pen, pencil, and ruler.
You may use an eraser and a calculator if needed.

Information for candidates:

1. Write your name and school on this page.
2. Write all of your answers on the question papers in the space provided. If you need additional paper then please ask the invigilator. Please put your name on the sheets of paper you use.
3. The marks for each question or part question are shown in square brackets [ ] after the question.
4. Answer **ALL QUESTIONS**.
5. The total mark for this paper is 60.

BIOLOGY

Question 1

Thera and Kamran want to know if birds are more attracted to some colours than others. They carried out the following experiment:

- They mixed nuts and seeds with some melted lard (fat) and split the mixture into 3 bowls.
- They added either red, green, or blue food colouring to each of the bowls.
- They formed the mixture into balls and left them to harden.
- They placed the balls into 3 different bird feeders (like the one in the picture) and hung them from a branch of the oak tree in the school playground.
- They observed the feeders for 1 hour and counted how many birds visited each feeder.
- They repeated the observation for the next 2 days.

a. What is the independent variable in this investigation? [1]

_____

b. What is the dependent variable in this investigation? [1]

_____

c. Give two ways in which the students could ensure that this is a fair test. [2]

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8 birds visited the red food on the first day, 5 on the second day and 8 on the third day. 4 birds visited the blue food on the first day, 2 on the second day and 9 on the third day. On the first day 10 birds visited the green food, on the second day 8 birds visited the green food and on the third day 12 birds visited the green food.

d. Calculate the mean average for each colour. Put the students' results and your mean calculations in a suitable table. [3]

e. Thera concluded that all birds prefer to eat green food. Kamran is not confident about this conclusion. Explain why Kamran is not confident with this conclusion. [4]

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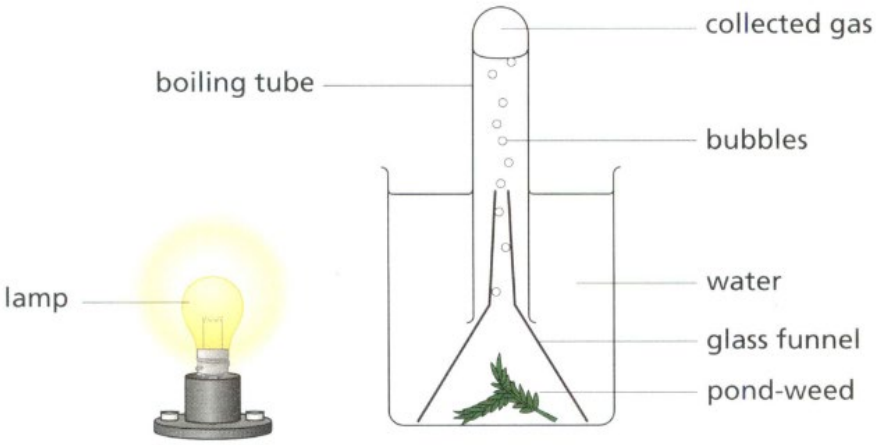
Question 2

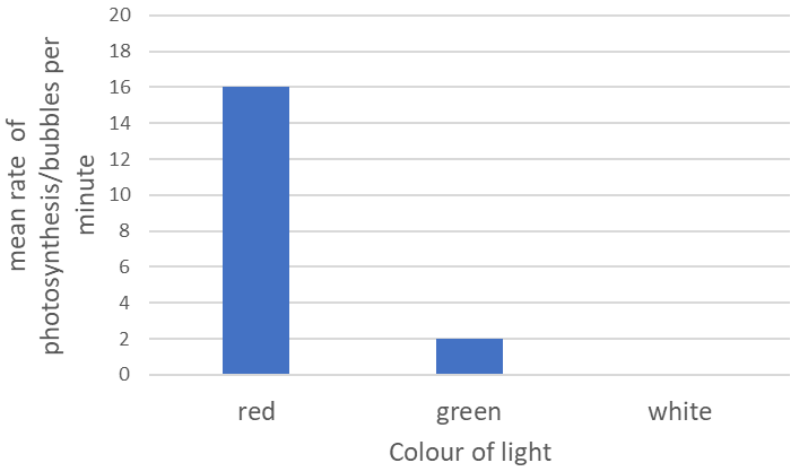
David and Elodie wanted to investigate whether the colour of light affected the rate of photosynthesis in pond weed. They set up the apparatus as shown in the diagram, but they used either a red or a green light bulb instead of an ordinary light bulb.



They counted the number of bubbles for one minute and repeated this three times for red and green light. Below are the table of results and the graph they produced.

a. Fill in the missing values in the table. [3]

Colour of light	Rate of photosynthesis/bubbles per minute			
	1st repeat	2nd repeat	3rd repeat	Mean average
Red	15	14		
Green		1	3	



b. Predict the mean result if the students had repeated the experiment with white light by adding a bar to the chart. [1]

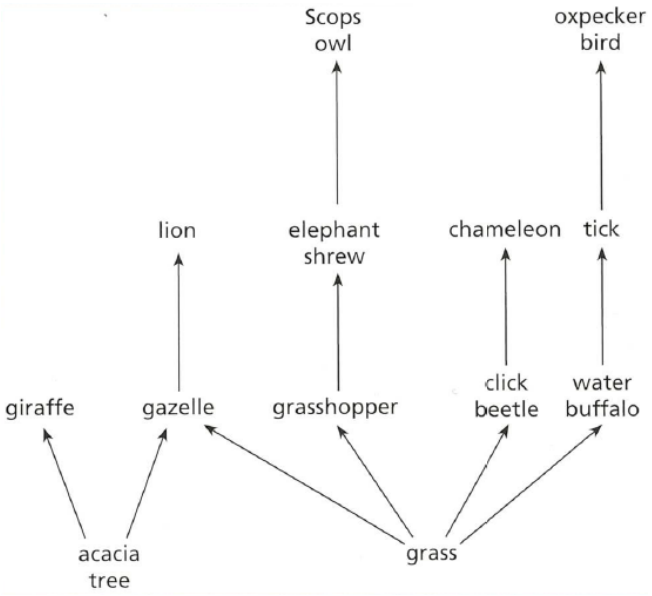
_____

c. Give one factor that the students would have needed to control in this investigation to ensure a fair test. [1]

_____

Question 3

The following diagram shows a food web of a community on the African savannah. The table describes some of the relationships that exist within the community.



Relationship	Description
Predator/prey	The predator feeds on the prey
Mutualism	Two organisms that have a relationship that is beneficial to both organisms
Parasitism	Two organisms that exist together but only one benefits and the other can be harmed but generally is not killed

a. Name the producers in this food web. [1]

_____

b. Name one secondary consumer from the food web. [1]

_____

c. Explain why the oxpecker and the water buffalo have a mutualistic relationship with each other. [2]

_____

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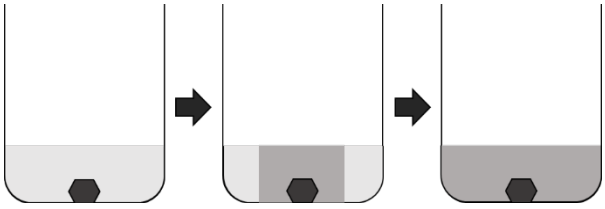
Total for BIOLOGY: 20 marks

CHEMISTRY

Question 1

An experiment was carried out to investigate the effect of temperature on the rate of diffusion.
A crystal of purple potassium permanganate was placed in the centre on beakers of water of different temperatures and the time taken for the purple colour to spread to the edge of the beaker was recorded.

Water temperature (°C)	Time taken (s)
10	1200
20	500
30	210
40	90
50	40



a. Plot a graph of these data. Your graph should include axis labels with units and a line of best fit. [5]

b. Suggest two things that should be kept constant in this investigation to ensure the validity of the results. [2]

i) _____

ii) _____

c. Predict how long the purple colour would take to reach the edge of the beaker in water with a temperature of 60 ^{o}C. [1]

_____ seconds

d. Describe and explain the relationship between temperature and rate of diffusion. [2]

_____

_____

_____

Question 2

Iron and copper can both be extracted from their oxides by heating them with carbon.

iron oxide + carbon → iron + carbon dioxide

copper oxide + carbon → copper + carbon dioxide

a. State the type of reaction that is taking place when these metal oxides are heated with carbon. [1]

_____

b. 16.0 g of copper oxide reacted exactly with 1.2 g of carbon. This produced 12.8 g of copper. What mass of carbon dioxide should have been produced during this reaction? [1]

_____ grams

c. Another student also heated 16.0 grams of copper oxide with 1.2 gram of carbon but only 11.6 grams of copper was produced. Suggest why a smaller amount of copper was obtained. [1]

_____

_____

d. If aluminium oxide is heated with carbon, no reaction takes place. Explain why this is the case. [2]

Question 3

Describe the environmental problems posed by a chemical compound of your choice. Explain the measures which can be taken to prevent further harm to the environment by this compound and the measures which could be taken to reduce the damage already done. [5]

Total for CHEMISTRY: 20 marks

PHYSICS

Question 1

This question is about a parachutist.

a. A parachutist leaves a helicopter that is hovering above the ground. The parachutist falls vertically downwards. They accelerate due to gravity at a rate of 10 m/s^2. Calculate the speed of the parachutist after they have fallen through a distance of 1300 m. (Ignore the effect of air resistance.) [3]

You may like to use the relationship:

final speed^2 = initial speed^2 + (2 x acceleration x distance)

final speed = _____ m/s

b. When the parachutist is much nearer to the ground, they open their parachute which causes them to slow down.

i. Explain the change in speed of the parachutist. **Use ideas about forces** in your answer. [4]

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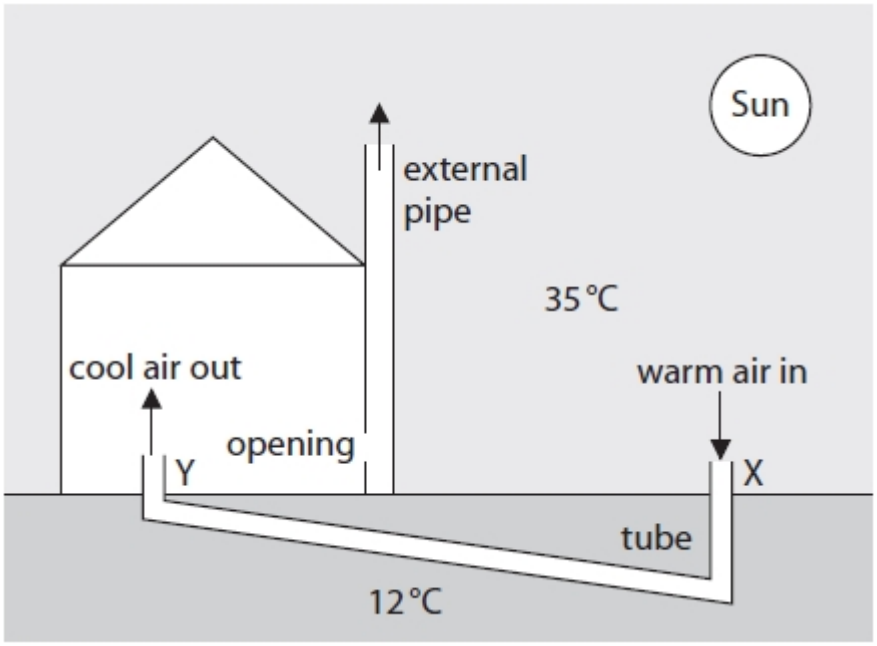
ii. A few seconds later, the parachutist reaches a low constant speed and drifts down to the ground. Describe the energy transfers taking place during this time. [3]

Question 2

The diagram shows a building in a hot climate. The air temperature is 35 °C and the underground temperature is 12 °C.

The external pipe is heated by the Sun. This causes cool air to enter the house through a tube in the ground.



a. How is energy transferred to the external pipe from the Sun? [1]

- ☐
- ☐
- ☐
- ☐

b. If you were designing this house, what colour would you paint the external pipe? [1]

_____

c. Explain why air moves upwards through the external pipe. [3]

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d. Warm air enters the tube at point X. Cool air leaves the tube at point Y.

Explain how the air is cooled as it travels through the tube. [3]

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a. The underground pipe is very expensive to build but vital to keeping the house cool.
If each metre that the air travels through this pipe causes its temperature to drop by 0.5°C, what is the maximum length of pipe it would be worth installing? [2]

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Total for PHYSICS: 20 marks