22nd International Mathematics and Science Olympiad (IMSO)

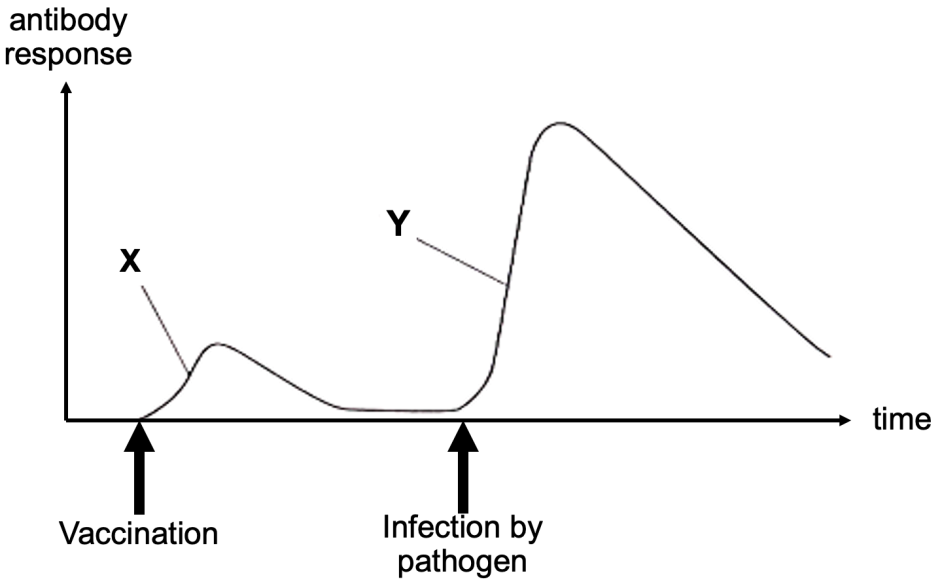
Science Theory 2 Test

Kedah, Malaysia
06 October 2025

Instructions:

1. Do not turnover this page until you are told to do so.
2. Write your ID Number and Seat Number on each space provided in the answer sheet.
3. Write your answer only on the separate answer sheet. There are 6 pages in the answer sheet.
4. Answer all the questions in English.
5. There are 9 questions printed on a total of 8 pages, excluding this cover page.
6. You have 90 minutes to complete this test.

1. Joshua caught the flu and his body slowly produced antibodies to fight the virus. A few months later, Joshua was given a vaccine for the same virus. This time, his body responded much faster and made more antibodies. The graph below shows the two immune responses **X** and **Y** of Joshua following two occurrences.



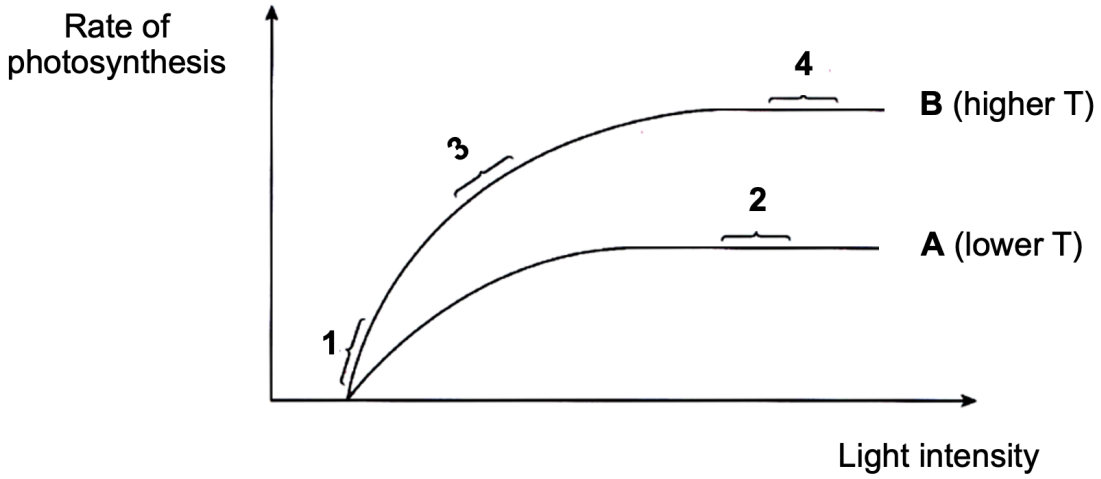
   a. What are two things/occurrences that can make Joshua's body produce antibodies? [1 mark]

   b. Why does not Joshua get the symptoms after getting vaccinated? [1 mark]

   c. How is Joshua's second response **Y** different from his first response **X**? [1 mark]

   d. Even when Joshua's antibody level goes down, how can his body still fight the virus in the future? [1 mark]

2. The graph below shows the results of the effect of light intensity on a plant's rate of photosynthesis at two different temperatures, **T**. Curve **A** was obtained from a plant kept at lower temperature, while curve **B** was obtained from a plant kept at a higher temperature.



a. State the factor which was affecting the rate of photosynthesis at regions **1** and **3** on the graph. Justify your answer. [2 marks]

b. Explain what influences the data gathered at region **2**. [2 marks]

c. Other than the factor which you have mentioned in your answer for Question 2a, state ONE other factor that affects the rate of photosynthesis. [1 mark]

3. A study was conducted to investigate the relationship between transpiration and changes in a tree's stem diameter. A dendrograph was used to continuously measure the stem's diameter over a period of time, as shown in the figure below.

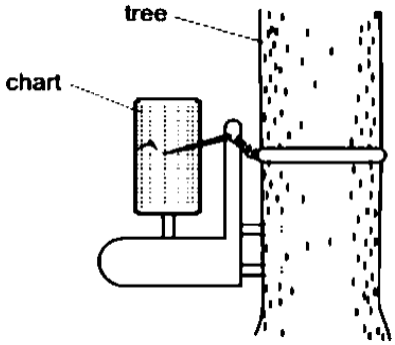


Fig. 1

Data were collected in the following table:

Time of the day	**Stem diameter (mm)**
6:00	4.6
12:00	4.0
18:00	4.6
24:00	5.0
6:00	4.6
12:00	4.0
18:00	4.6
24:00	5.0
6:00	4.6

a. Using the provided data, create a line graph that illustrates the change in the tree's stem diameter over time. [2 marks]

b. Using the provided data, describe the overall pattern of change in the tree's stem diameter over the 24-hour period. [2 marks]

c. Provide a scientific explanation for the pattern observed during the night. [2 marks]

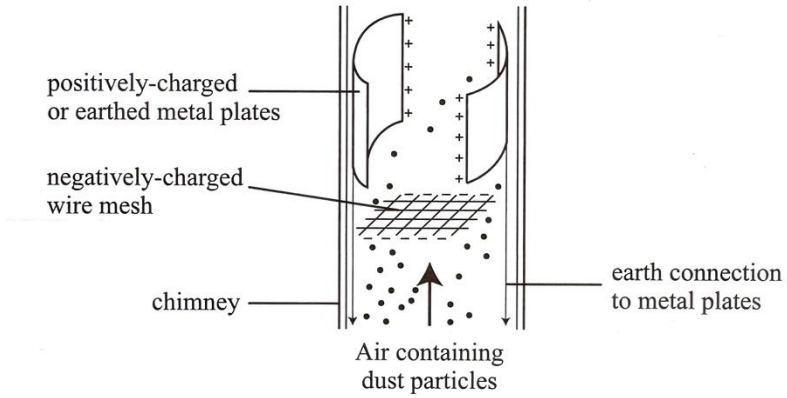
4. You have a balloon that has been blown up and then released without tying the end. The balloon moves forward as the air rushes out.

   a. What type of energy is stored in a balloon when it is blown up? [1 mark]

   b. Assume that the balloon and the escaping air have a combined mass of 0.05 kg. After the balloon is released, it reaches a velocity of 8 m/s in air. Calculate the kinetic energy of the balloon at this velocity. [2 marks]

   c. If the balloon were released in a vacuum, would you expect the kinetic energy of the balloon to be greater than, less than, or the same as the kinetic energy calculated in Part b? Explain your answer. [2 marks]

5. Dust removal from air can be achieved by means of an electric field. When air containing dust particles passes through a fine wire mesh, the particles become negatively charged. Subsequently, the air is directed between two positively charged metal plates, where the charged dust particles are attracted and collected, as illustrated in the figure below.

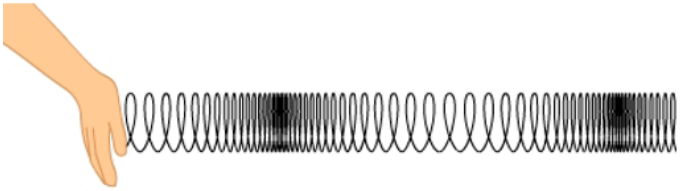


   a. Explain how the dust particles become negatively charged when they pass through the wire mesh. [2 marks]

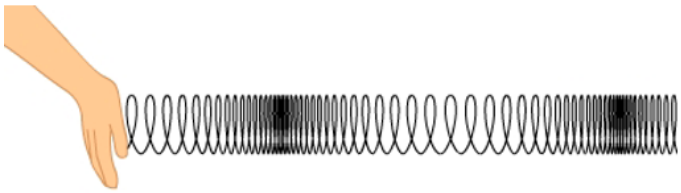
   b. Explain what happens to the dust particles as they pass through the electric field. [2 marks]

   c. Complete the diagram to show the electric field between two dust particles before they entered the electric field. Use three arrows to show the behavior of the particles. [1 marks]

6. In a Physics lesson, Mr. Wong demonstrates wave motion using a slinky. One end of the slinky is fixed to the wall, while the other end is moved repeatedly from side to side. This motion produces a wave that propagates along the slinky with a constant speed. The diagram below represents the slinky at a particular instant in time.



a. On the diagram below, indicate a **compression** by labeling it with **C**, and a **rarefaction** by labeling it with **R**. [1 mark]

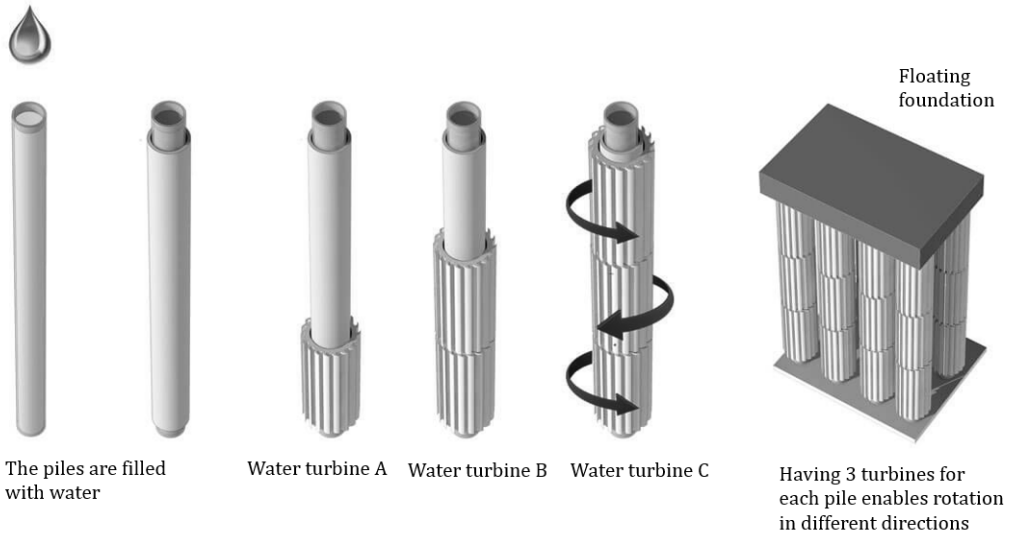


b. On the same diagram, identify and mark a distance equivalent to one wavelength, and denote it with the symbol λ. [1 mark]

c. If Mr. Wong doubles the speed of his hand movement, what effect will this have on the wavelength? What does this observation reveal about the relationship between wavelength and frequency? [2 marks]

d. Provide one real-world example of a wave that resembles the motion of the slinky. [1 mark]

7. The diagram below shows a futuristic design for a seawall that functions also as an energy generator. It is designed to be used together with battery technology. The sites considered can be coastal areas like a river mouth or urban coastal areas.

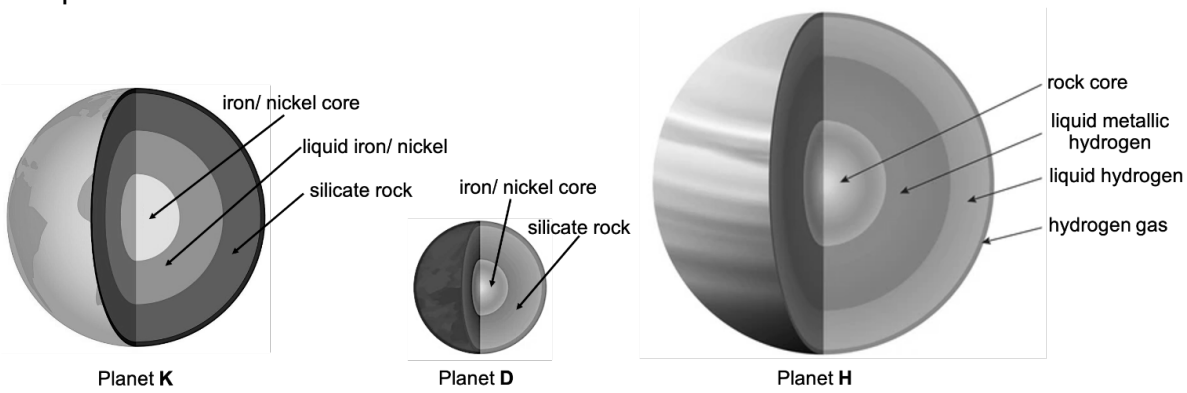


Source: https://www.waterstudio.nl/projects/floating-breakwater/

a. Study the structures of the seawall carefully and explain in detail how it functions as a seawall and energy source. (2 marks)

b. State one (1) advantage and one (1) disadvantage of the design of this seawall shown in the above diagram. (2 marks)

8. The figures below are unnamed planets **K**, **D**, and **H** and their internal composition. These are not drawn to scale.

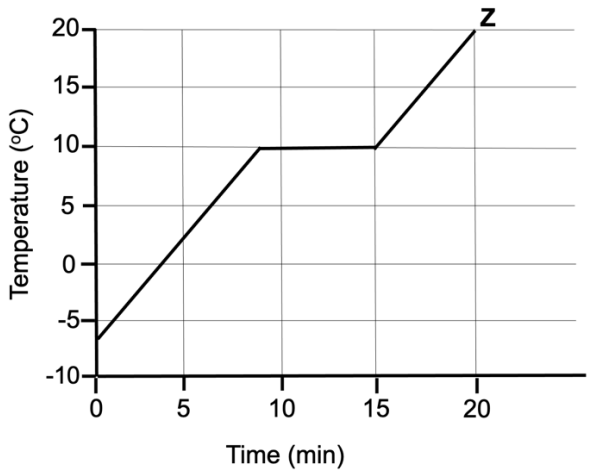


a. Compare the three planets. Identify one (1) similarity that all three share, and explain one (1) major difference (2 marks)

b. The planets can be classified into two main groups. Propose a classification scheme based on the figure and justify your reasoning by referring to both composition and observable physical properties. (2 marks)

c. Planet **H** has a rock core surrounded by liquid metallic hydrogen and liquid hydrogen. Suggest how this internal structure might influence Planet **H**'s strong magnetic field compared to Planet **K** and Planet **D**. (2 marks)

9. A student performs an experiment to determine the melting point of an unknown solid substance **G**. She takes the substance in a beaker and starts heating. She immersed a thermometer into the beaker and noted the change in temperature every minute. She then plotted the change in temperature of the substance against time and obtained a graph like below:



a. What is the melting point of substance **G** in degrees Celsius? (1 mark)

b. Why does the temperature remain constant from 9th min to 15th min of the experiment? (1.5 marks)

c. Using (O) to represent particles of substance **G**, draw at least ten particles as they would appear at point **Z**. (1 mark)

d. If we allow the same sample of the same compound to cool down, draw the resulting graph. (1.5 marks)