



SIR ARTHUR LEWIS COMMUNITY COLLEGE
ACADEMIC YEAR (2024/2025) – SEMESTER ONE
END OF SEMESTER EXAMINATION

COURSE CODE : PHY002
COURSE TITLE : Elementary Physics 1
LECTURER(S) : Brandon Scott
DATE : 16th December 2024
TIME : 1 p.m. – 3 p.m.
DURATION : 2 Hours
STUDENT ID # : _____

GENERAL INFORMATION AND INSTRUCTIONS

- Students must sign **IN** and **OUT** on the examination class list.
- Write your ID number on the question paper.
- **Attempt ALL FOUR (4) questions** and write solutions on the answer sheet/s graph paper/s provided.
- Ensure that units are included in **all working and final answers** where appropriate.
- The use of a scientific calculator is permitted. No graphing calculators are allowed.
- All graphs should be drawn with a pencil and labels should be written in pen.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

Constants:

Acceleration due to gravity = 10.0 ms^{-2}

1. A horse and rider take part in a long distance race. The graph shows how far the horse and rider travel during the race.

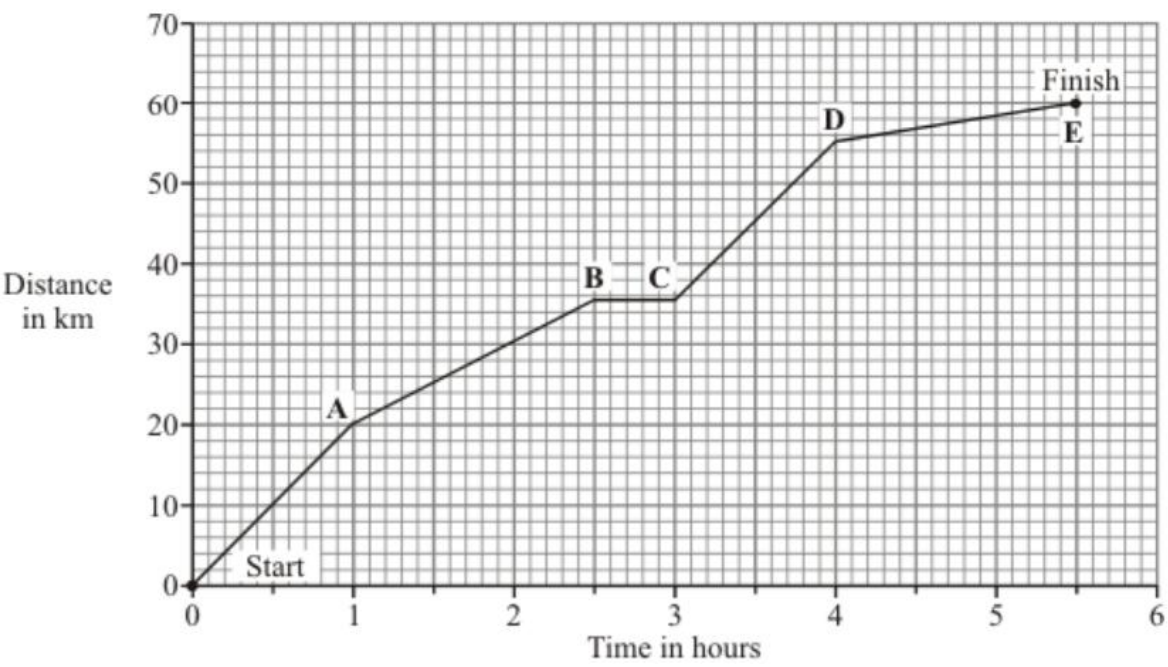


Figure 1

- a. Describe the motion of the horse between points A to B and B to C. (2 marks)
 - b. Calculate the speed of the horse between points C and D. (3 marks)
 - c. Convert the speed found in part (b) to ms^{-1} . (3 marks)
 - d. Would you expect the speed of the horse between points C and D to be greater or lesser than points D to E and why? (2 marks)
- (Total: 10 marks)

2. Two physics students were asked to work together to investigate the relationship between extension, e , and the stretching force, F , for a spiral spring. Four sets of their results are shown in Figure 2.

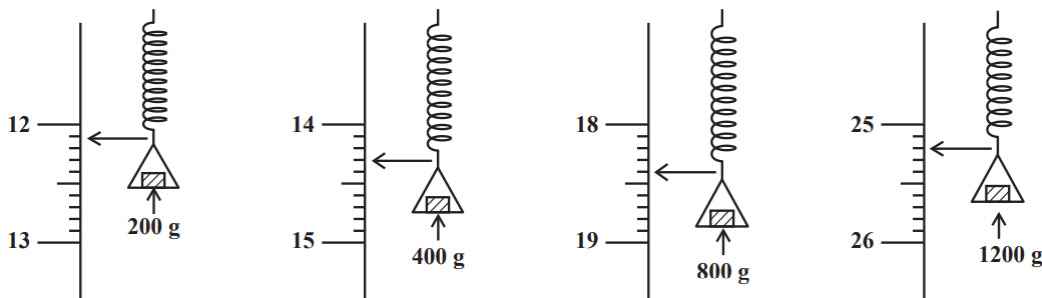


Figure 2

Mass (m)/g	Stretching force (F) /N	Scale Reading /mm	Extension (e) /mm
0	0	10.0	0.0
200	2		
400	4		
600	6	16.3	6.3
800	8		
1000	10	21.4	11.4
1200	12		

Table 1

- Use the results from Figure 2 to copy and complete Table 1. (4 marks)
- Plot a graph of stretching force, (F) against extension, (e). (5 marks)
- Identify the part of the graph where Hooke's law is NOT obeyed. Label the beginning and end of the part as A and B respectively. (1 mark)
- Draw a line of best fit through the straight line portion of the graph. Then, calculate the gradient of the straight line portion of the graph. (3 marks)
- What quantity does the gradient of the graph represent? (1 mark)

(Total: 14 marks)

- During a space mission, a satellite travelling at a constant velocity of 35 ms^{-1} collides with orbital debris and is redirected.

a. Calculate the initial momentum of the satellite before the collision, assuming its mass is 1500 kg. (3 marks)

b. After the collision, the satellite changes to the opposite direction and slows down to 4 ms^{-1} . What velocity did the debris fragment move away with if the debris fragment weighs 500 kg and had an initial velocity of 75 ms^{-1} ? (3 marks)

(Total: 6 marks)

- The conservation of mechanical energy states that if there are no forces other than gravity acting on a particle during its motion, then the sum of its kinetic and potential energies remains constant. A water balloon of mass 5 kg is released from a drone hovering 4 m above a swimming pool. It falls directly downward and hits the water surface with a speed of $v \text{ ms}^{-1}$.

a. Find the gravitational potential energy of the water balloon at its initial height. (3 marks)

b. Write an expression in terms of v for the kinetic energy of the water balloon as it hits the water surface. (1 marks)

c. Calculate the value of v in ms^{-1} . (2 marks)

d. Write an assumption you have made in part (c). (1 mark)

- e. If it takes the water balloon 0.90 s to fall from its maximum height to the water surface, calculate the power released by the water balloon when it hits the water.
(3 marks)

(Total: 10 marks)

END OF EXAM