SULIT

SP015 SP015

Physics 1 Fizik 1

Semester 1 semester 1

Session 2023/2024 Sesi 2023/2024

2 hours 2 jam

KOLEJ MATRIKULASI KEDAH

PRA

PEPERIKSAAN SEMESTER PROGRAM MATRIKULASI

(PRA-PSPM)

SET 1

JANGAN BUKA KERTAS SOALAN SEHINGGA DI BERITAHU.

DO NOT OPEN THIS QUESTION PAPER UNTIL YOU ARE TOLD TO DO SO.

Answer **all** questions.

1 You have a ladder that has a length of 4.5 m leaning against a building at an angle of 75° to the horizontal. You climb from the bottom of the ladder to the top. How far do you move?

(a) Horizontally

(b) Vertically

[2 *marks*]

2 (a) **FIGURE 2** shows the velocity-time graph for an object moving along a straight path. Calculate the

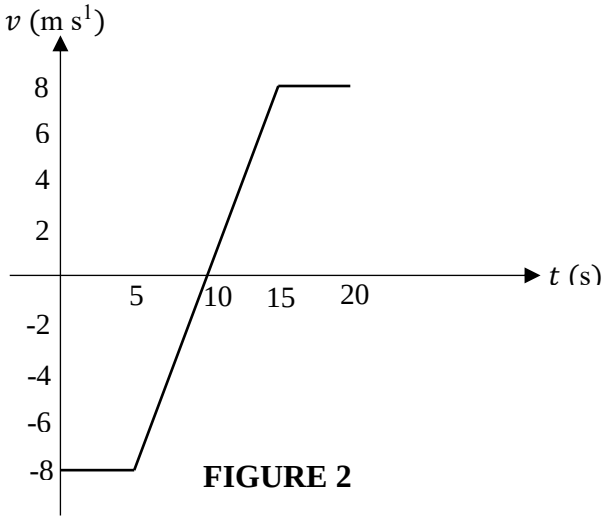

FIGURE 2

(i) average acceleration of the object during the time intervals 5.0 s to 15.0 s

(ii) displacement and total distance travelled during the time intervals 5.0s to 15.0 s.

[5 *marks*]

(b) A cheetah running with a constant acceleration covers the distance between two points 90 m apart in 6.70 s. Its speed as it passes the second point is 15 m s^{-1}. Calculate the cheetah's speed at the first point.

[2 *marks*]

(c) An object is projected at an angle of 40˚ below the horizontal from the cliff of height 90 m. After 3.5 s, it reaches the ground. Calculate

(i) the initial velocity of the object.

(ii) the horizontal displacement of the object.

[3 *marks*]

3 (a) Object A is moving with velocity 40 m s^{-1} collide with object B at rest. Both of the object has the same mass. After the collision, both objects move in different direction as shown in **FIGURE 3.1**. Calculate the magnitude of velocity of both object after the collision.

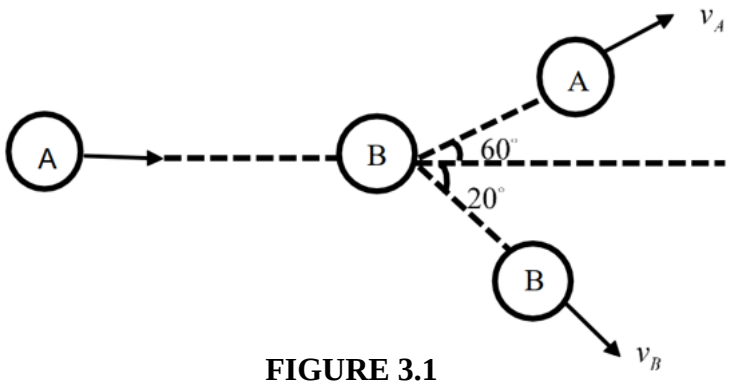

FIGURE 3.1

[5 *marks*]

3 (b) Box A of mass 30 kg is connected to box B by rope on a rough horizontal surface and pulled by force of 70 N as shown in **FIGURE 3.2**. The boxes are moving with a constant velocity. Angle between force, F and the horizontal surface is 25º. Coefficient of kinetic friction between the surface and the boxes is 0.05.

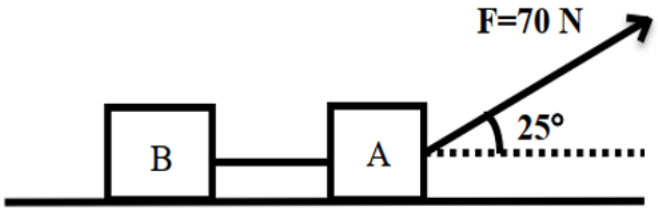

FIGURE 3.2

(i) Draw two separate free body diagrams which shows all the forces acting on block **A** and **B**.

(ii) What is the value of tension acting on the rope connecting block **A** and **B**?

(iii) What is the mass of block **B**?

[8 *marks*]

4 (a)

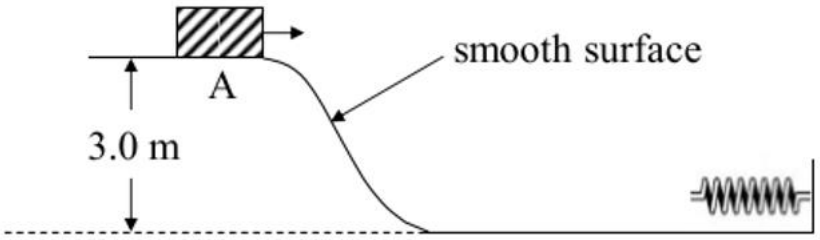

FIGURE 4.1

A block of mass 0.10 kg is placed at A, as shown in **FIGURE 4.1**. The spring has a spring constant of 500 N m^{-1}. The block starts to move with an initial speed of 3.0 m s^{-1}. It travels down the slope and finally compresses the spring.

(i) Determine the maximum compression undergone by the spring.

(ii) If a stiffer spring is used, explain what will happen to the maximum compression.

[3 *marks*]

(b) An object of mass 2.0 kg travels along horizontal floor under the action of force, F. **FIGURE 4. 2** shows the graph of force, *F* against displacement, *s*. The speed of the object at *s* = 0 is 10 m s^{-1}. Determine the kinetic energy of an object at *s* = 10 m.

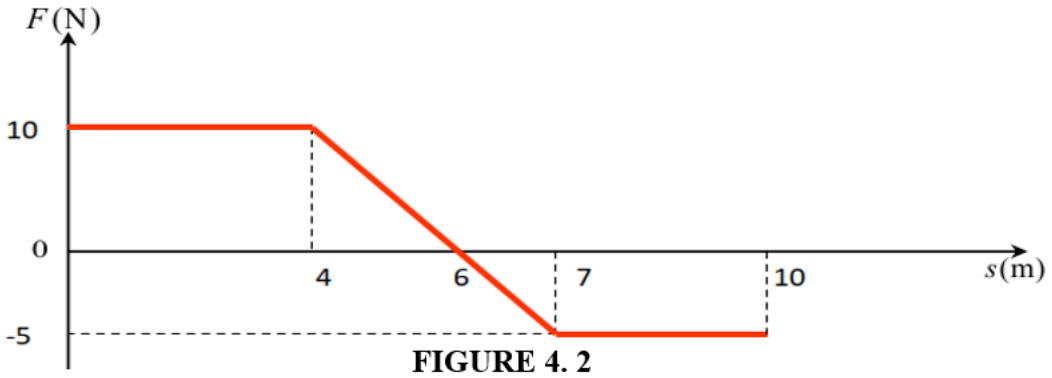

FIGURE 4. 2

[2 *marks*]

(c) A stationary bus of mass 2500 kg starts to accelerate with constant acceleration 1.5 ms^{-2}. Determine

(i) the average power produced by the bus engine if the bus reaches a speed of 12.0 m s^{-1} in 8.0 s.

(ii) the power of the bus engine at time *t* = 5.0 s.

[3 *marks*]

5 A car with mass of 1500 kg moves with constant speed along a horizontal curve of radius 70.0 m The coefficient of static friction between the road and the tires is 0.72. Calculate the

(a) centripetal force acts on the car.

(b) maximum speed of the car without skidding.

[5 *marks*]

6 (a)

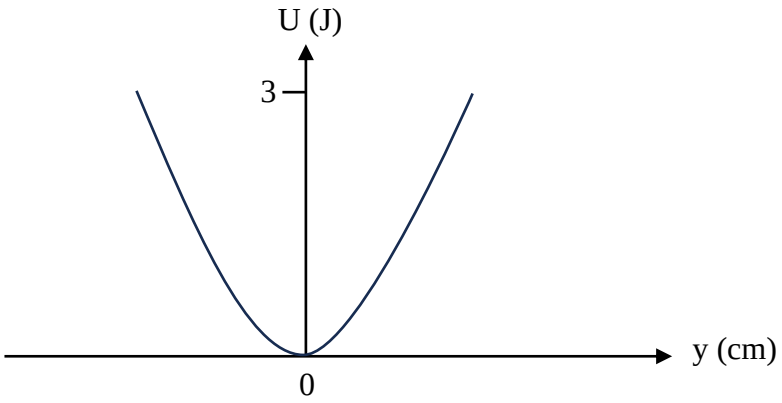

FIGURE 6.1

FIGURE 6.1 shows how potential energy with diplacement for a mass-spring system that oscillates about the equilibrium position O. The spring constant is 2 N cm^{-1}.

(i) Calculate the maximum displacement

(ii) Calculate the position when the kinetic and potential energy are equal .

(iii) If the amplitude of the oscillation is doubled, what will happen to its total energy ?

[4 *marks*]

(b) A transverse sine wave with an amplitude of 3.50 mm and a wavelength of 1.60 m travels from left to right along a long, horizontal, stretched string with a speed of 30 m s^{-1}. Take the origin at the left end of the undisturbed string. At time t = 0, the left end of the string has no upward displacement. Determine the

(i) frequency, angular frequency, and wave number of the wave.

(ii) displacement equation for the wave.

(iii) displacement equation for a particle at x = 0 m.

(iv) displacement equation for a particle x =1.40 m.

(iv) maximum magnitude of transverse velocity of any particle of the string.

(v) transverse displacement and the transverse velocity of a particle at x =1.40 m to the right of the origin at time t = 0.05 s.

[11 *marks*]

(b) (i) The tension in a stretched wire of length 0.50 m and mass 1 g per meter is 40 N. Calculate the fundamental frequency of the wire when it vibrates. [Speed of sound in air = 330 m s^{-1}]

(i) A tube of a certain length and open at both ends has a fundamental frequency of 300 Hz. The second harmonic of this tube and the third harmonic of another tube which is closed at one end have the same frequency. What is the length of each of these tubes? Ignore end corrections.

[Speed of sound = 343 m s^{-1}]

[4 *marks*]

(d)

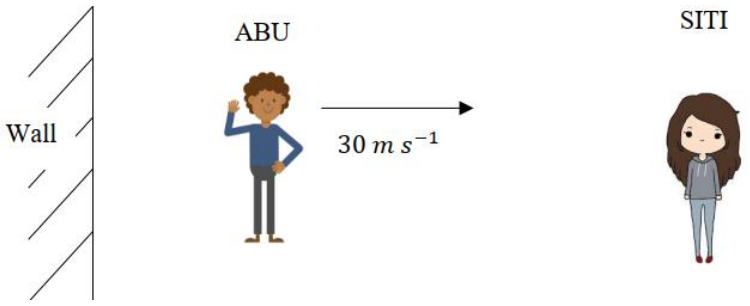

FIGURE 6.2

FIGURE 6.2 shows that Siti is standing still. Abu is walking towards Siti away from the wall with speed 30 m s^{-1} while talking to her. Abu emits a frequency of 500 Hz. The speed of sound in air is 340 m s^{-1}. Determine

(i) the apparent frequency heard by Siti directly from Abu.

(ii) the apparent frequency heard by Siti due to reflection of the wall.

[4 *marks*]

7 (a) A wire is used to support a box of mass 1300 kg at one of it end. The extension of the wire cannot exceed 3.5 mm. The characteristics of two wires are shown in the **TABLE 7** below. Which wire is suitable to be used to support the box? Justify your answer using calculation.

wire	Length (m)	Young Modulus (Pa)	Cross sectional area (m^2)
P	**6.6**	$\mathbf{9.4 \times 10^{10}}$	$\mathbf{2.6 \times 10^{-4}}$
Q	**6.6**	$\mathbf{9.8 \times 10^{10}}$	$\mathbf{2.3 \times 10^{-4}}$

TABLE 7

[4 *marks*]

(b) A window that is 0.50 cm thick has dimensions of 95 cm x 35 cm with a temperature difference across the glass equal to 25 °C, calculate the amount of heat that will flow through in 5.0 minutes. [k_{glass} = 0.80 W m^{-1} K^{-1}]

[2 *marks*]

(c) A circular aluminium plate is cooled from 155 °C to 25 °C. Given that the area decreases 4 cm^2, what is the initial area of the plate?
[coefficient of area expansion for aluminium is 48×10^{-6} °C^{-1}]

[2 *marks*]

8 (a) A 1.5 mol ideal monoatomic gas is stored in a container at 25°C. Calculate the
(i) translational kinetic energy per molecule
(ii) internal energy of the gas.

[4 *marks*]

(b) An ideal gas has a molar mass 46 g mol^{-1}. Calculate the root mean square speed of the molecules at -10°C.

[2 *marks*]

(c) Two mole of an ideal gas is expanded isothermally from V to 4V. The work done by the gas is 5.6×10^3 J.
(i) Sketch a P-V graph for this process.
(ii) Calculate the heat transferred during the expansion. Is the heat absorbed or released by the system?
(iii) What is the temperature of the gas?

[7 *marks*]

END OF QUESTIONS PAPER