SULIT
SP015/1
Physics 1
Paper 1
Semester I
Session 2022/2023
2 hours

SP015/1
Fizik 1
Kertas 1
Semester I
Sesi 2022/2023
2 jam

KOLEJ MATRIKULASI KEDAH

PRA PEPERIKSAAN SEMESTER PROGRAM MATRIKULASI (PRA PSPM)

SET 1

JANGAN BUKA KERTAS SEHINGGA DIBERITAHU.

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

Kertas soalan ini mengandungi __ halaman bercetak.

This question paper consists of __ printed pages.

Answer all the questions

1. The gravitational force, F_g of an object on earth is given by the equation, $F_g = \frac{Gm_1m_2}{r^2}$ where m_1 and m_2 is the masses of particle 1 and 2, r is the distance between particle 1 and particle 2. Determine the dimension of the Universal gravitational constant, G.

[2 marks]

2. a) FIGURE 1 shows a graph of a car travelling from point O at t=0 sec.

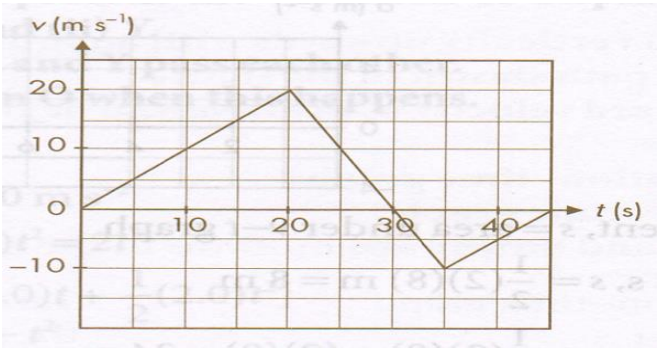

FIGURE 1

i) Calculate the acceleration of the car in the first 20 s.

ii) What is the distance travelled by the car from point O when it first come to stop?

[5 marks]

b) A ball is kicked at an angle of 37° above the horizontal with a speed of 30 m s^{-1} and landing on the same ground. Calculate the

i) maximum height.

ii) time of flight.

iii) horizontal range of the ball. [5 marks]

3 (a) A 8 kg body moves towards the west with a momentum of 30 kg m s^{-1}. A 20 N force to the east acts on the body for a period of 15 s. Determine the magnitude of

i) the impulse of the force.

ii) the change in the momentum of a body.

iii) the final momentum of the body.

iv) the final velocity of the body.

[5 marks]

(b).

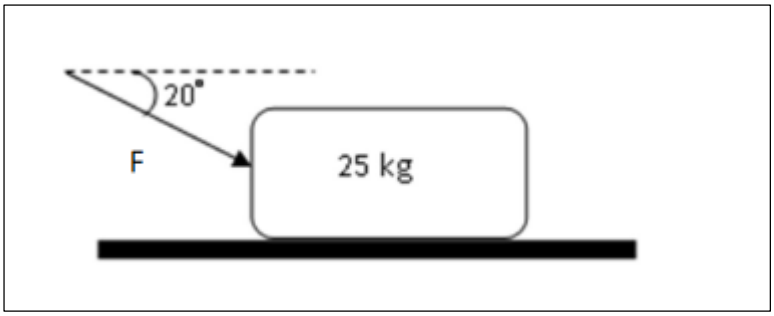

FIGURE 2

In **FIGURE 2**, A 25 kg crate is pushed at constant speed across a rough horizontal floor with a force of F = 20 N, directed 20^{O} below the horizontal.

i) Sketch a free-body diagram of the crate.

ii) Determine the normal reaction on the crate.

[8 marks]

4. (a) Two tugboats tow a disabled oil tanker. Each tug exerts a constant force of 5.0×10^{6} N in the direction of 30° and 20° as illustrated in **FIGURE 3** They pulled the tanker 0.75 km along the vertical line. What is the total work they do on the oil tanker?

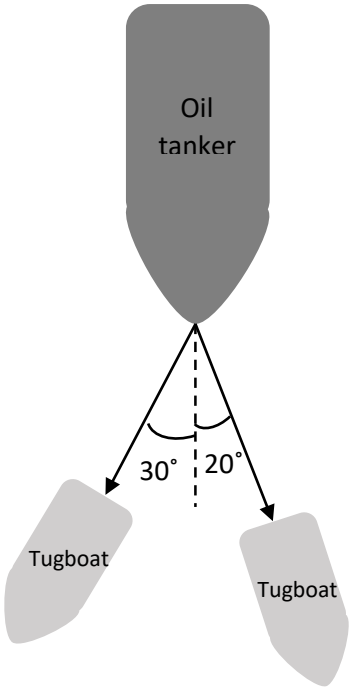

FIGURE 3

[2 marks]

(b) The force applied to an object against its displacement is shown in **FIGURE 4**. Determine the value of Y if the work done by the force applied is 712.5 J.

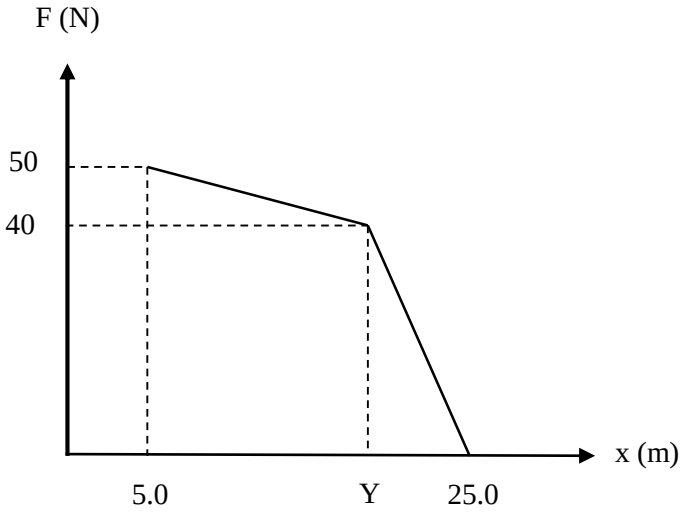

FIGURE 4 [2 marks]

(c) **FIGURE 5** shows cyclist travels 2000 m along the steep road of angle 25˚ at an average speed of 4.5 m/s during the mountain stage of the Tour de Langkawi. The mass of the cyclist and bicycle is 70 kg. Calculate the total mechanical energy of the cyclist and bicycle at the end of the finishing line.

FIGURE 5

[2 marks]

(d) A 118 g arrow with speed 150 m s^{-1} penetrates 0.10 m into a static wooden armour. Determine work done by the armour using Work-Energy Theorem.

[1 mark]

(e) An electric powered machine pulls a rope tied to a wooden crate fully loaded with fruits upward at a constant speed of 0.25 m/s. The electric power used is 68 W. What is the tension in the rope?

[1 mark]

5. An energetic father places his 22.0 kg child on a 6.0 kg cart to which a 2.0 m long rope is attached. He then holds the end of the rope and spins the cart and child around in a horizontal circle, keeping the rope parallel to the ground. If the tension in the rope is 100 N and rolling friction between the cart's wheels and the ground is negligible, determine

(a) the speed of the cart during the motion.

[3 marks]

(b) how many revolutions per minute (rpm) does the cart make

[2 marks]

6 (a) A 175 g mass on a smooth surface is attached to a horizontal spring with a spring constant 8 N m^{-1}. The mass is set to oscillate by pulling it 10 cm from its equilibrium position and released. Calculate

(i) The period of oscillation.

(ii) Total energy of the system

(iii) Potential energy and kinetic energy at distance 5 cm from the equilibrium.

(iv) On the same graph sketch and label the variation of kinetic energy, K and potential energy, U versus displacement, x. On the graph, indicate the maximum value of energy and its amplitude.

[10 marks]

(b) Displacement equation of stationary wave is given by $y = 3\cos(0.1\pi x)\sin(100\pi t)$, where y and x in unit cm. Determine

(i) Amplitude of particle when $x = 2$ cm

(ii) Wavelength

(iii) Frequency

(iv) Speed of wave

[7 marks]

(c) Length of air column closed at one end is 0.92 m. A stationary wave is formed in the air column when a source emitting sound is positioned near the open end. Calculate the frequency of the fundamental tone and second overtone produce. (Given speed of sound is 330 m s^{-1})

[4 marks]

(d) When a truck approaches a stationary observer at 55 m s^{-1}, it produces sound with a frequency of 1125 Hz. Calculate the apparent frequency of the sound as heard by the observer. (Given speed of sound is 330 m s^{-1})

[2 marks]

7 (a) A 10 kg load is attached to a vertical 1.8 m steel wire causes the wire to extended by 0.60 mm. Calculate the extension of the wire causes by another 2 kg load added to the system. Given the Young's modulus of steel is 200 GPa.

[3 *marks*]

(b) A 55 m^2 composite wall of a building consists of brick and concrete with the thickness of 12.0 cm and 24.0 cm respectively. The temperature of the outside surface of the brick and concrete is 40^0C and 20^0C respectively. Determine the temperature of the interface between the brick and the concrete. (Given coefficient of thermal conductivity of brick and concrete are 0.6 W m^{-1} $^0C^{-1}$ and 0.8 W m^{-1} $^0C^{-1}$ respectively)

[3 *marks*]

(c) A steel tank is completely filled with 3.0 m^3 of glycerine at 32^0C. The tank is then cooled to 18^0C. The coefficients of linear and volume thermal expansion for steel and glycerine are 1.1×10^{-5} K^{-1} and 4.8×10^{-4} K^{-1} respectively. Calculate the additional volume of glycerine can be filled into the tank.

[2 *marks*]

8. (a) A gas of mass 345 g is held in a square container with a volume of 0.55 m^3 at a pressure of $1.7x10^5$ Pa. Determine the root mean square speed of the gas molecules. [4 marks]

(b) A container contains 0.4 m^3 of gas at 30 ^{o}C and 2 atm. The gas is compressed isothermally to half its original volume and pressure becomes 4 atm, then the gas is allowed to expand isobarically back to its original volume. (number of mole of gas, n = 32 mol)

i. With the same axes, sketch and label *p*-*V* graphs for these two processes.

ii. What is the work done for the whole processes?

[7 marks]