SF016/2
Physics
Paper 2
Semester I
Session 2013/2014
2½ hours

SF016/2
Fizik
Kertas 2
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2½ jam

BAHAGIAN MATRIKULASI
KEMENTERIAN PENDIDIKAN MALAYSIA
MATRICULATION DIVISION
MINISTRY OF EDUCATION MALAYSIA

PEPERIKSAAN SEMESTER PROGRAM MATRIKULASI
MATRICULATION PROGRAMME EXAMINATION

FIZIK
Kertas 2
2 ½ jam

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIBERITAHU.
DO NOT OPEN THIS QUESTION PAPER UNTIL YOU ARE TOLD TO DO SO.

Kertas soalan ini mengandungi **21** halaman bercetak.
This question paper consists of **21** *printed pages.*

*Answer **question 1** and **any other five** questions.*

1

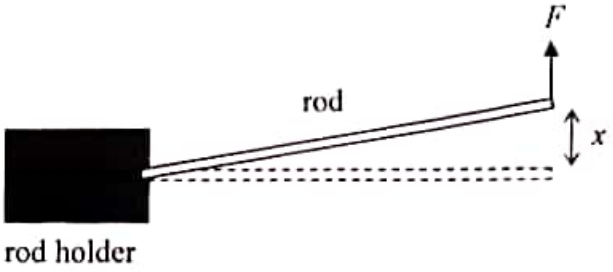

FIGURE 1

FIGURE 1 shows the deflection, x of a rod for different magnitudes of van der Waals force, F. The results of the measurement are given in **TABLE 1**.

TABLE 1

F (nN)	x (nm)
1.6	1.2
3.1	2.0
4.5	2.8
5.8	3.5
7.0	4.2
8.4	5.0

(a) Plot a graph of F against x.

[8 *marks*]

(b) Determine the gradient **and** the intercept of the graph.

[5 *marks*]

(c) (i) Write the equation for the straight line of the graph.

(ii) Determine the force constant, k of the rod.

[2 *marks*]

2 (a)

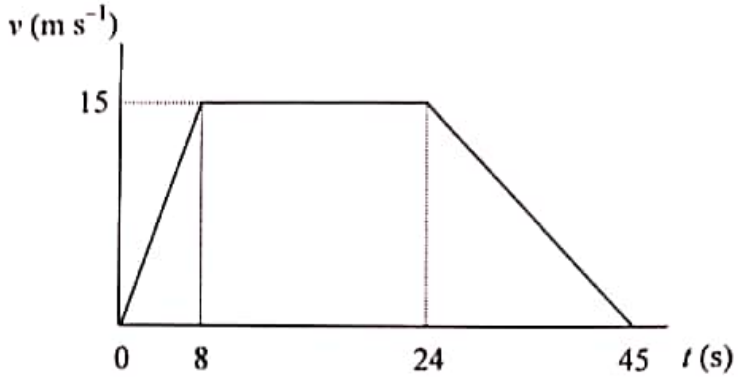

FIGURE 2

FIGURE 2 shows a velocity-time graph of a motion along a straight line.

(i) Calculate the average velocity **and** average acceleration of the entire motion.

(ii) Sketch a labelled displacement-time graph of the motion.

[7 *marks*]

(b)

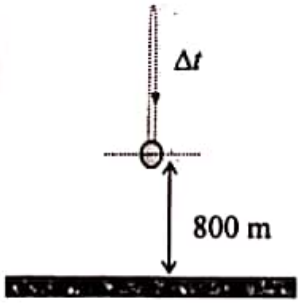

FIGURE 3

A bullet is fired vertically upwards with an initial speed of 600 m s^{-1}. Calculate the time interval, Δt for the bullet to be 800 m above ground as shown in **FIGURE 3**.

[3 *marks*]

(c) (i) Why is the displacement and velocity in a projectile motion can be analysed separately in the x and y-directions?

(ii) A projectile is launched with a velocity of 45 m s^{-1} at an angle of 60° from the horizontal. Determine the time when the velocity makes an angle 30° with the horizontal for first time.

[5 *marks*]

3 (a) What is meant by impulse?

[1 *mark*]

(b)

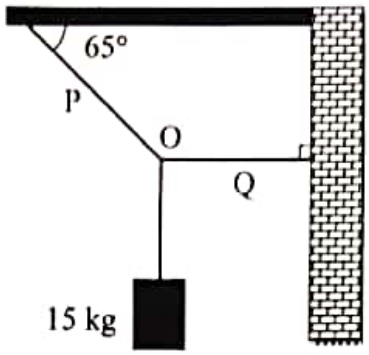

FIGURE 4

FIGURE 4 shows a 15 kg load held in equilibrium by ropes, P and Q fastened to the ceiling and the wall respectively.

(i) Sketch a free body diagram at point O.

(ii) Calculate the tension of ropes P **and** Q.

[7 *marks*]

(c)

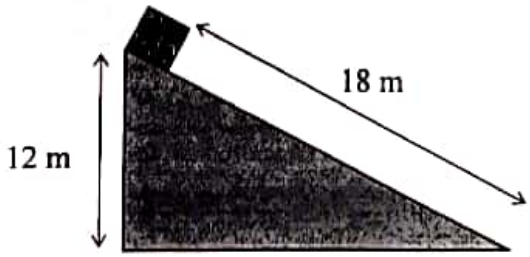

FIGURE 5

FIGURE 5 shows a block held at rest at the top of a 18 m long rough slope with coefficient of kinetic friction 0.19. The height of the box on the slope is 12 m. When released, the block slides down.

(i) Calculate the final speed of the block at the bottom of the slope.

(ii) If the mass of the block is increased, will the final speed of the block decrease, same or increase? Justify your answer.

[7 *marks*]

4 (a) (i) Define centripetal force.

(ii) Why is the direction of centripetal acceleration always perpendicular to the velocity?

[3 *marks*]

(b) A 60 cm conical pendulum bob revolves freely. The pendulum string makes an angle of 37° with the vertical.

(i) Sketch and label a free body diagram of the pendulum bob.

(ii) Calculate the speed of the pendulum bob.

(iii) Calculate the angular velocity of the pendulum bob.

(iv) If the angle remains unchanged but a longer string is used, will the angular velocity decrease, same or increase? Justify your answer.

[9 *marks*]

(c) (i) Define gravitational field strength.

(ii) The mass and radius of the earth are 5.974×10^{24} kg and 6371 km respectively. Calculate the period of revolution of a satellite that is 100 km above the earth surface.

[3 *marks*]

5 (a) Define

(i) angular acceleration.

(ii) moment of inertia.

(iii) angular momentum.

[3 *marks*]

(b) A ceiling fan is rotating at an angular speed of 300 rpm when the switch is turned off. It takes 45 s for the fan to stop. Calculate the

(i) average angular acceleration.

(ii) number of revolution the fan makes before it stops.

[4 *marks*]

(c)

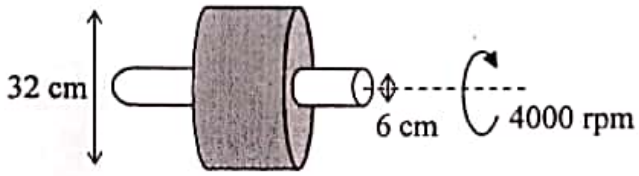

FIGURE 6

FIGURE 6 shows a 2.76 kg solid disc of diameter 32 cm with a 2.66 kg solid cylindrical axle of diameter 6 cm. The moment of inertia of the hollow disc is $\frac{1}{2}M_{\text{disc}}\left(R_1^{\,2}+R_2^{\,2}\right)$ where R_1 is radius of solid disc and R_2 is radius of cylindrical axle. The moment of inertia cylinder is $\frac{1}{2}M_{\text{cylinder}}R_2^{\,2}$. Calculate the

(i) moment of inertia of the system about the axis of the cylindrical axle.

(ii) energy required to rotate the system about the axis from an angular speed of 1000 rpm to 4000 rpm.

[5 *marks*]

(d) A solid sphere and a solid cylinder from rest roll without slipping down a slope from the same height. Both of them have the same mass and radius. Given the moment of inertia of the solid sphere and solid cylinder are $\frac{2}{5}MR^2$ and $\frac{1}{2}MR^2$ respectively, which one of them will reach the bottom of the slope first? Justify your answer.

[3 *marks*]

6 (a) The displacement, x of a simple harmonic motion given by the equation,

$$\frac{d^2x}{dt^2} = -\omega^2 x$$

where ω is a constant associated with the motion. What is meant by the equation?

[1 *mark*]

(b)

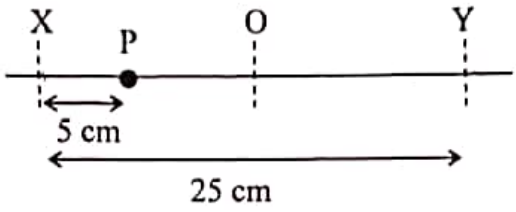

FIGURE 7

FIGURE 7 shows a bead executing a simple harmonic motion with a period of 1.8 s, along a straight line between points, X and Y which are 25 cm apart. Point O is at midpoint between X and Y.

(i) Write an equation for the displacement of the bead.

(ii) Calculate the magnitude of acceleration **and** velocity of the bead at point P.

(iii) Calculate the positions along XY when the kinetic energy and the potential energy of the bead are equal.

[9 *marks*]

(c) A vertical spring extends by 3 cm when a 100 g mass is suspended at its end.

(i) Calculate the period of oscillation of the spring when a mass of 150 g is added to the system.

(ii) If the spring with the same load is allowed to oscillate horizontally on a frictionless surface, will the period decrease, same or increase? Justify your answer.

[5 *marks*]

7 (a) A progressive wave is represented by equation,

$$y(x,t) = 1200\sin(314t - 0.42x)$$

where x and y are in cm and t is in second. Determine the

(i) velocity of the wave.

(ii) maximum velocity of the particle.

[4 *marks*]

(b) A mechanical wave propagates at 550 m s^{-1} along a string stretched to a tension of 800 N. The string oscillates at fundamental frequency 440 Hz. Calculate the

(i) mass per unit length of the string.

(ii) length of the string.

(iii) frequency of the second overtone **and** sketch the waveform of the overtone.

[7 *marks*]

(c) Define

(i) sound intensity.

(ii) Doppler effect.

[2 *marks*]

(d)

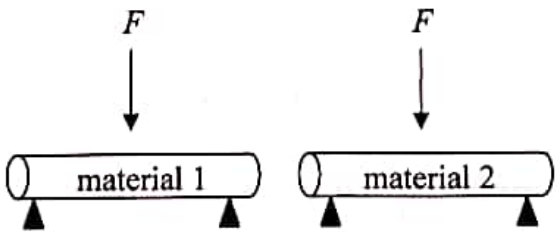

FIGURE 8

FIGURE 8 shows an identical force, F acting on two identical rods but made of different materials. What concept will be used to determine which rod will bend more? Explain your answer.

[2 *marks*]

8 (a) Define the following thermodynamics processes:

(i) Adiabatic

(ii) Isobaric

[2 *marks*]

(b) (i) Calculate the heat transferred in 24 hours through a 2.4 m^2 metal sheet of thickness 1 cm when the temperature difference between the surfaces is 0.5 °C. Given the thermal conductivity coefficient of the metal is 16 $W\ m^{-1}\ K^{-1}$.

(ii) The mass of an empty 50 litres gas cylinder is 4.8 kg. The cylinder is filled with nitrogen gas up to a pressure of 60 atm. Given the room temperature 29 °C and the molecular weight of nitrogen 28, calculate the new mass of the cylinder.

[5 *marks*]

(c) Derive the equation for the work done in an isothermal process.

[3 *marks*]

(d)

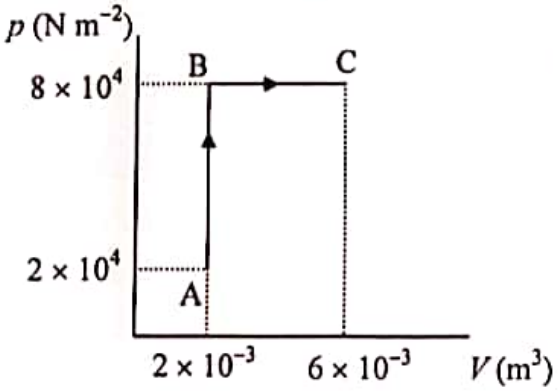

FIGURE 9

FIGURE 9 shows a *p-V* graph for a series of thermodynamic processes, ABC. In process AB and BC, 160 J and 600 J are added to the system respectively. Calculate the change of the internal energy during the process ABC.

[5 *marks*]

END OF QUESTION PAPER