SF016/2

Physics
Paper 2
Semester I
Session 2017/2018
$2\,^1/_2$ hours

SF016/2

Fizik
Kertas 2
Semester I
Sesi 2017/2018
$2\,^1/_2$ jam

BAHAGIAN MATRIKULASI
MATRICULATION DIVISION

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 17 halaman bercetak.
This question paper consist of 17 printed pages.

*Answer **question 1** and **any other 5** questions.*

1

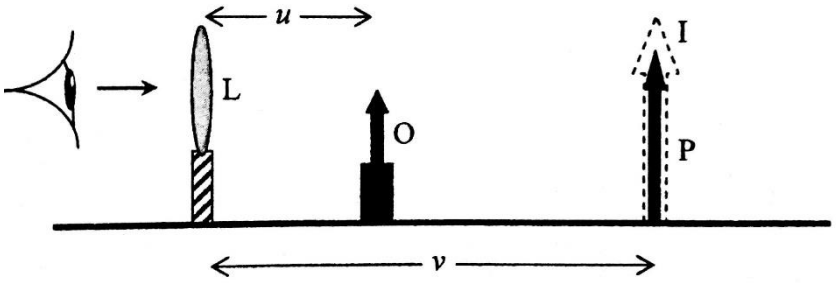

FIGURE 1

FIGURE 1 shows an experiment using a simple magnifier to determine the near point distance D of an eye. The magnified virtual image 1 (dotted line) of an object O was observed through a lens L. The object distance u was adjusted such that the image was formed in coincident with the locating pin P, preset at a fixed distance v = 30 cm. The respective values of u for different focal lengths f is shown in TABLE 1 . The magnification M is related to the focal length by

$$M = \frac{D}{f} + 1$$

f (cm)	u (cm)	$\frac{1}{f}\ (cm^{-1})$	$M = \frac{v}{u}$
8.00	6.65		
10.00	7.35		
12.00	8.50		
15.00	11.00		
20.00	11.60		
30.00	13.50		

Image distance, v = 30.0 cm

(a) Copy and complete **TABLE 1.**

(b) Plot a graph of M against $\frac{1}{f}$.

(c) Determine the near point distance D from the graph.

2 (a) Define

(i) average velocity

(ii) instantaneous velocity

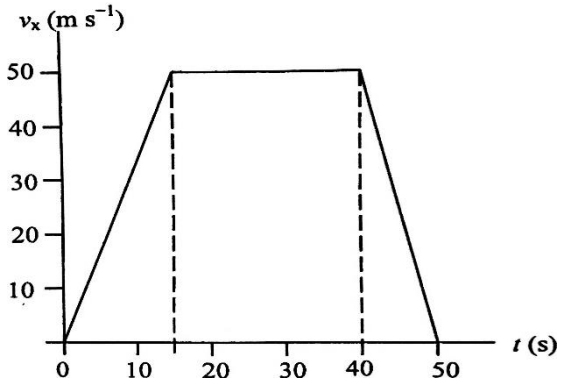

FIGURE 2

FIGURE 2 represents a part of the performance data of a car.

(i) Calculate the total distance travelled from the graph.

(ii) Draw a graph of its acceleration against time between t = 0 and t = 50 s. Show your calculation.

(c) A ball on the field was kicked with an initial velocity of 16.5 m s^{-1} at an angle of 35^0 above the horizontal line. After passing a maximum height, the ball hits the goal post bar at a height of 3 m from the ground.

(i) Determine the time taken by the ball to hit the bar.

(ii) Calculate the distance of the goal post from the footballer.

3 (a) State one (1) similarity and one (1) difference between elastic collision and inelastic collision .

(b) A tennis player hits a 0.06 kg ball horizontally approaching at 50 m s^{-1} perpendicular to his racquet's surface. He returns the shot at 40 m s^{-1} in the opposite direction.

(i) Calculate the impulse to the ball by the racquet.

(ii) How much work does the racquet do on the ball?

(iii) If the ball hits the plane of the racquet at an angle, will the impulse delivered to the ball increase, decrease or remain the same? Explain.

(c)

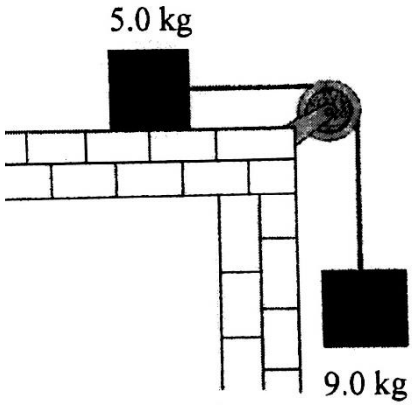

FIGURE 3

FIGURE 3 shows a 5 kg box placed on a frictionless horizontal table, is connected to a 9 kg hanging box by a string that passes over the pulley.

(i) Draw free-body diagrams of both boxes.

(ii) Determine the magnitude of the acceleration of both boxes.

(iii) Determine the magnitude of the tension in the string.

4 (a) (i) State the Newton's law of gravitation.

(ii) Define centripetal acceleration.

(b) The international space Station (ISS) is launch from the Earth and orbiting at an altitude of 350 km.

(i) Sketch and label the variation of the gravitational potential against distance from the surface of the earth experienced by the ISS during the journey.

(ii) The ISS has the weight of $4.22 \times 10^6\ N$ when it is measured on the surface of the earth. Given the mass and radius of the earth is $5.98 \times 10^{24}\ kg$ and $6.38 \times 10^6\ m$ respectively, calculate the weight of the ISS when in its orbit.

(c)

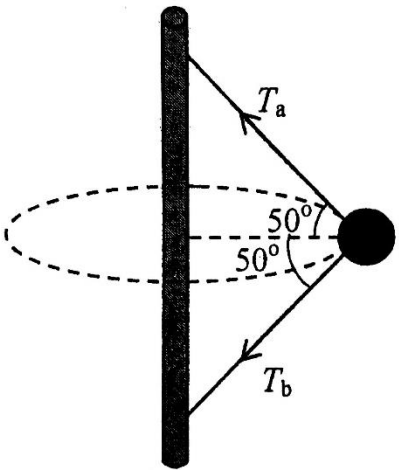

FIGURE 4

FIGURE 4 shows a 4 kg object is attached to a vertical rod by two strings. The object rotates in a horizontal circle of radius 1.3 m at constant sped 6 m s^{-1} . Calculate the

(i) tension T_a in the upper string.

(ii) tension T_b in the lower string.

5 (a) (i) State 2 conditions for the equilibrium of a rigid body.

(ii) Define angular momentum.

(b) A disc of 8 cm in radius rotates at a constant rate of 1200 revolutions per minutes about its central axis. Calculate the

(i) angular velocity in rad s^{-1}

(ii) tangential speed at a point 3 cm from its center.

(iii) distance travelled by a point at the edge of the disc in 2 s.

(c)

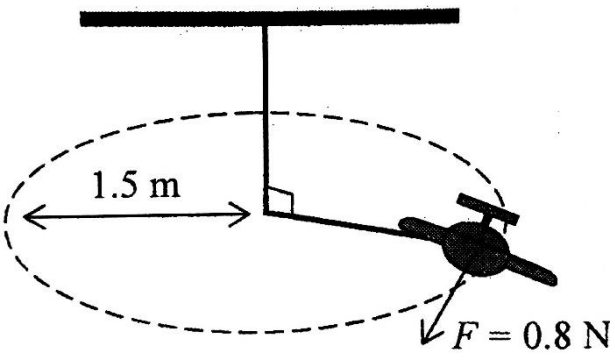

FIGURE 5

FIGURE 5 shows a 0.75 kg airplane model is attached by an arm rod of negligible mass flies in horizontal circle 1.5 m in radius. The airplane model acts a force of 0.8 N perpendicular to the rod. By assuming the airplane as a point mass, calculate the

(i) torque about the axis pasing through the center of the circle

(ii) angular acceleration of the airplane

(iii) linear acceleration of the airplane tangent to its flight path.

6 (a) Why a simple harmonic motion is a periodic motion without energy loss?

(b) In an engine, a 200 g piston oscillates in a simple harmonic motion with displacement varying according to $x(t) = 5 \cos 2t$ where x is in meter and t is in second.

(i) Write the expression for its vibrational velocity as a function of time, $v(t)$.

(ii) Sketch the graph of velocity against time of the piston for the first complete cycle starting from $t = 0$

(iii) Calculate the maximum acceleration of the system.

(iv) Calculate the total energy of the system.

(c) Explain by the derivation why the period of simple pendulum does not depend on the mass of the bob but the period of a mass –spring system depends on the mass of the load.

7 (a) (i) How does sound intensity change with distance from a point source?

(ii) In a longitudinal wave in a horizontal spring, the coils move back and forth in the direction of wave motion. If the coil speed is increased, does the wave propagation speed decrease, remain the same or increase? Explain tour answer.

(b) A progressive transverse wave travelling on a wire has amplitude of 0.2 mm and a frequency of 500 Hz with speed of 196 m s^{-1} .

(i) Write the displacement equation of the wave.

(ii) If the mass per unit length of the wire is 4.1 g m^{-1} calculate the tension of the wire.

(c) A submarine that travels in the water at a speed of 8 m s^{-1} and emits a sonar wave of frequency 1400 Hz is approaching another stationary submarine. Given

the speed of sound in water is 1530 m s^{-1} , calculate the apparent frequency as detected by the observer in the stationary submarine.

(d) A 20 cm cylindrical brass rod with diameter 6 cm is held vertically on its one circular flat end. A load of 5 kg is placed on its upper end. Given the Young's modulus of brass is $9.1 \times 10^{11}\ N\ m^{-2}$, calculate the strain energy of the rod.

8 (a) (i) Define heat.

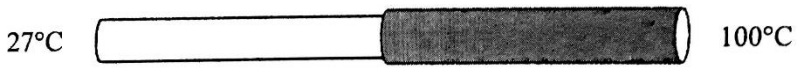

FIGURE 8.1

(ii) **FIGURE 8.1** shows a rod with both ends at different temperatures. The right half of the rod is insulated while the left half is not insulated. Sketch a graph of temperature against distance of the rod.

(b) (i) A $5 \times 10^{-3}\ m^3$ tank contains nitrogen at 27^0 C and pressure 1.2 atm. The gas pressure increases to 2.5 atm when the tank is heated. Given the molar mass of nitrogen is 28 g mol^{-1}, calculate the change in the rms speed of the nitrogen molecules.

(ii) At the same temperature, which gas has a greater energy per mole, a diatomic gas or a monoatomic gas? Explain your answer.

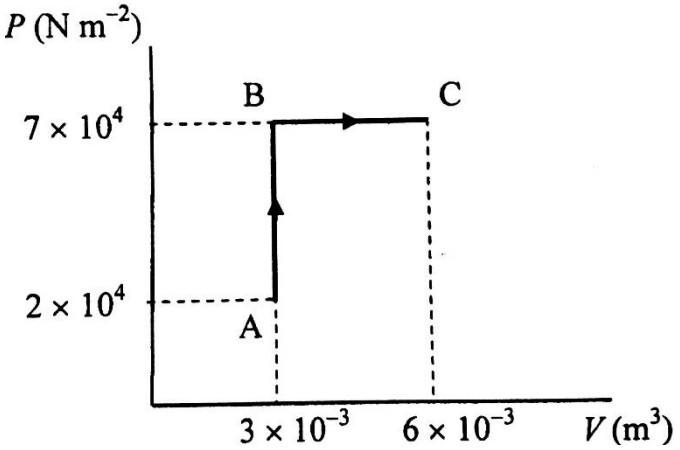

FIGURE 8.2

(c) **FIGURE 8.2** shows a series of thermodynamic processes ABC. During the process AB and process BC, 120 J of heat and 500 J of heat are added respectively. Calculate the change in the internal energy in the process ABC.