**SF016/2**

*Physics*
*Paper 2*
*Semester I*
*Session 2015/2016*
*$2\,^1/_2$ hours*

**SF016/2**

Fizik
Kertas 2
Semester I
Sesi 2015/2016
$2\,^1/_2$ 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** In an experiment, a 400 g wooden block is pulled on a horizontal wooden surface. The limiting friction, $f_s$ between the block and wooden surface is measured repeatedly by adding load, m on the block as given in TABLE 1.

**TABLE 1**

| Length, $l$ (cm) | Frequency, f(Hz) | Period, T(s) |
|---|---|---|
| 14.2 | 256 | |
| 12.8 | 289 | |
| 10.9 | 325 | |
| 9.7 | 384 | |
| 8.6 | 444 | |
| 7.6 | 486 | |

**2** (a) Describe a free falling body

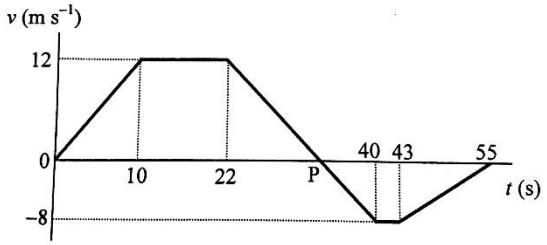


**FIGURE 1**

(b) **FIGURE 1** shows the velocity-time graph of a toy train moving on a straight track in 55 s.

(i) Determine the time and acceleration at point P when the velocity is zero.

(ii) Is the total distance travelled by the train less than, equal or greater than its total displacement? Justify your answer using calculation.

(c) A javelin is thrown with a speed of 55 m $s^{-1}$ at an angle of $42^0$ with the horizontal. Calculate the velocity of the javelin after 5 s.

**3** (a) (i) How is force related to momentum?

(ii) State a physical quantity used to indicate the difference between elastic collision and inelastic collision.

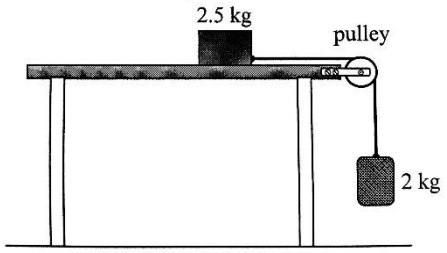


**FIGURE 2**

(b) **FIGURE 2** shows a 2.5 kg block connected to a 2 kg load by a light string through a pulley of negligible mass. The coefficient of kinetic friction between the block and table is 0.18. When the system is released, calculate the

(i) Acceleration of the block

(ii) Tension in the string.

(iii) Total kinetic energy of the system after the block has moved 0.6 m using the work – energy theorem.

(iv) Final velocity, $v_f$ of the block

(c) Assuming that the mass of the pulley in question **3**(b) cannot be neglected,will the new final velocity of the block be lower, the same or higher than the $v_f$ in **3**(b)(iv)? Explain your answer

**4** (a) (i) What is meant by centripetal force?

(ii) A cyclist rides on a horizontal circular track. With the aid of an appropriate labeled force diagram, explain why the cyclist has to lean towards the centre of the track.

(iii) Refer to the cyclist in question 9a(ii). Let *v* be the maximum speed of the cyclist, r the radius of the track, μ the coefficient of friction between the tyres and track, and *g* the gravitational acceleration. Determine μ in terms of *v*, *r* and *g*.

(b) (i) State Newton's law of gravitation.

(ii) Sketch a graph of gravitational field strength, $a_g$ against distance $r$ from the surface of the Earth. Label the radius of the Earth, *R* on the graph.

(iii) The radius and mass of planet Mars are 3390 km and 6.42 x $10^{23}$ kg respectively. Calculate the acceleration due to gravity at the surface of the planet.

(c) (i) Derive the period of a satellite motion.

(ii) Calculate the distance from the centre of the Earth for a satellite to remain above the same location on the Earth equator. The mass of the Earth is $5.97 \times 10^{24}$ kg.

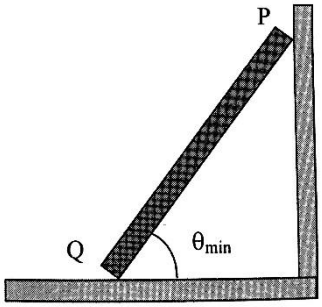


**FIGURE 3**

**5** (a) **FIGURE 3** shows a uniform beam PQ of weight 240 N leaning on a smooth wall and resting on a rough floor with a minimum inclination angle $\theta_{min}$. The coefficient of friction between the beam and floor is 0.25.

(i) State **two (2)** conditions for equilibrium of the beam.

(ii) Sketch **all** forces acting on the beam.

(iii) Determine the forces acting on the beam at P **and** Q.

(iv) Determine $\theta_{min.}$

(v) What will happen to the beam if the inclination angle is changed?

Consider both cases: $\theta_{new} < \theta_{min}$ and $\theta_{ncw} > \theta_{min}$ with $\theta_{new}$ less than 90°.

(b) A 15 N m torque acts on a grinding wheel after the power is switched off. Given the angular velocity of the wheel is 1200 *rpm* and its moment of inertia is 0.8 kg $m^2$, calculate the time for the wheel to stop.

**6** (a) (i) Define Simple Harmonic Motion (SHM)

(ii) Sketch a graph of potential energy against displacement for SHM.

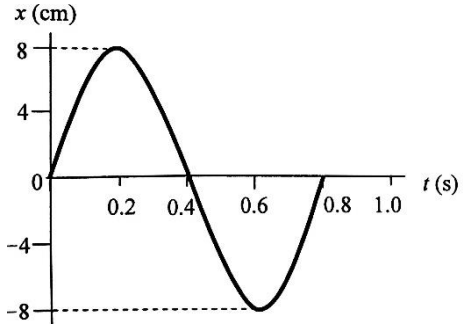


**FIGURE 4**

(b) A 0.2 kg object performs SHM with displacement, *x* from the equilibrium point as in **FIGURE 4.**

(i) Determine the amplitude.

(ii) Calculate the angular velocity.

(iii) Calculate the total energy of the system.

(c) The displacement *x* of a particle varies with time, t is given by

$$x = 4.0\ cos\ (2\pi t + \frac{\pi}{2})$$

where *x* is in cm and *t* in s. Calculate the

(i) frequency of the motion.

(ii) velocity of the particle at $t = 2$ s.

(iii) acceleration of the particle at $t = 2$ s.

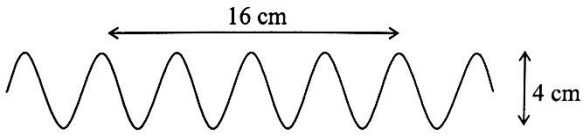


**FIGURE 5**

**7** (a) **FIGURE 5** shows a progressive wave travelling at a speed of 24 m $s^{-1}$ to the right.

(i) Determine the wave number.

(ii) Calculate the frequency of the wave.

(iii) Write the wave equation.

(b) A man stands by the roadside when an ambulance passes by him with constant velocity 18 m $s^{-1}$. The ambulance emits siren with frequency 256 Hz. The speed of sound is 340 m $s^{-1}$.

(i) Calculate the apparent frequency of the siren heard by the man before the ambulance passes by him.

(ii) Sketch a graph of the apparent frequency against distance travelled.

(iii) Sketch a graph of siren intensity against distance.

(c) (i) Why is Hooke's law not applicable in the case of plastic deformation?

(ii) A 50 cm wire has Young's modulus 175 GPa and diameter 0.25 mm. Calculate the force needed to elongate the wire 1.5 mm.

**8** (a) (i) Define the coefficient of volume thermal expansion.

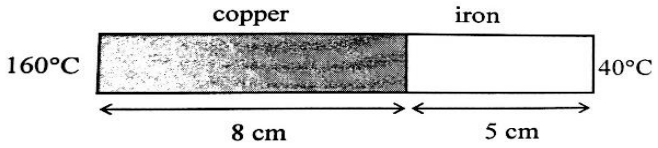


**FIGURE 6**

(ii) A composite rod is made by joining a copper rod of diameter 4 cm with an iron rod of similar diameter. The rod is insulated and its ends are kept at two different temperatures as shown in **FIGURE 6**. The coefficient of thermal conductivity of copper and iron are 385 W $m^{-1}$ $K^{-1}$ and 80 W $m^{-1}$ $K^{-1}$ respectively. Determine the temperature at the joint.

(b) (i) State the principle of equipartition of energy.

(ii) Calculate the *rms* speed of helium atoms at temperature 1 X $10^{-4}$ K. Molar mass of helium is 4 g $mol^{-1}$ .

(c) (i) On the same p – V graph, sketch individual curve for isothermal, isobaric and adiabatic process.

(ii) Explain why a gas becomes colder when it expands adiabatically.