SF 016/2
Physics
Paper 2
Semester I
Session 2016/2017
2 ½ hours

SF 016/2
Fizik
Kertas 2
Semester I
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2 ½ jam

KEMENTERIAN PENDIDIKAN MALAYSIA

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 five** questions.

1 The period T of vibration of a tuning fork with density ρ, Young's modulus Y and length l is given by

$$T = kl\sqrt{\frac{\rho}{Y}}$$

where *k* is a constant. The values of length *l* and frequency *f* are 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	

The density and modulus Young of the tuning fork are 8.2×10^3 kg m^{-3} and 2.3×10^{11} N m^{-2} respectively.

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

[2 *marks*]

(b) Plot a graph of T versus *l* .

[7 *marks*]

(c) Determine the gradient of the graph.

[4 *marks*]

(d) Determine the constant *k*.

[2 *marks*]

2 (a) Define free falling body.

[1 *mark*]

(b)

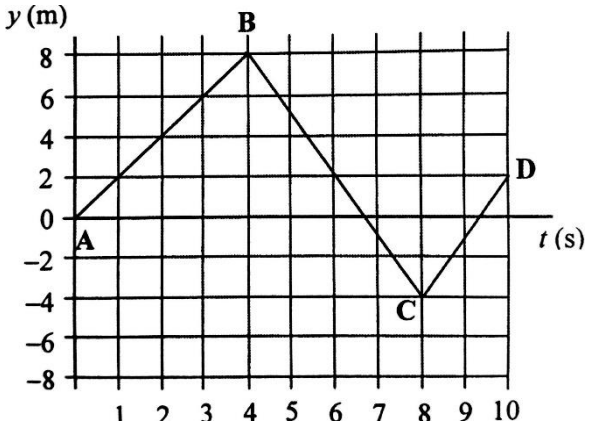

FIGURE 2

FIGURE 2 shows a displacement-time graph of a particle.

(i) Determine the total distance travelled by the particle.

(ii) Which segment of the journey does the particle move the slowest?

(iii) How many times does the particle return to its starting point?

[4 *marks*]

(c) A diver travelling at 100 km h^{-1} on a straight road suddenly sees a cow 32 m ahead and immediately applies the brake. His braking deceleration is 6 m s^{-2} . Calculate the

(i) speed when the car hits the cow

(ii) minimum time that he should apply the brake so that he does not hit the cow.

[4 *marks*]

(d) An archer standing on a cliff 48 m high shoots an arrow at an angle of 30^0 above the horizontal with a speed of 80 m s^{-1}. Calculate the

(i) duration the arrow is in the air

(ii) horizontal range of the arrow

[6 *marks*]

3 (a) State the principle of conservation of linear momentum. [1 *mark*]

(b)

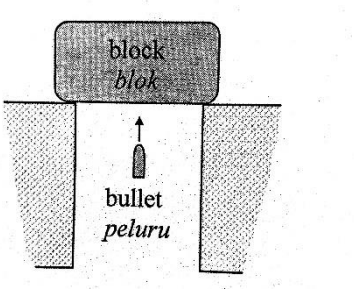

FIGURE 3.1

FIGURE 3.1 shows a 12 g bullet shot vertically into a 5 kg block and lifting it upwards to a maximum height of 4 mm. The bullet travelled for 1 ms in the block before stopping completely. Calculate the

(i) speed of the block and bullet just after collision.

(ii) impulse on the block.

(ii) depth of the bullet embedded in the block. [10 *marks*

(c)

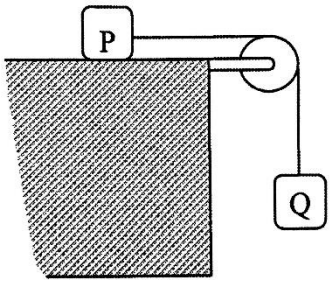

FIGURE 3.2

FIGURE 3.2 shows a stationary block P tied to a hanging block Q. The weight of block P is 25 N and the coefficient of static friction between block P and the horizontal surface is 0.4. Assume the pulley is smooth and the string is light.

(i) Sketch a free body diagram of block P.

(ii) Calculate the mass of block Q. [4 *marks*]

4 (a)

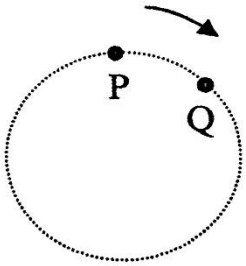

FIGURE 4.1

Sketch the change in the velocity of an object due to position P and Q which will show that the object is in a uniform circular motion as shown in **FIGURE 4.**1. [2 *marks*]

(b)

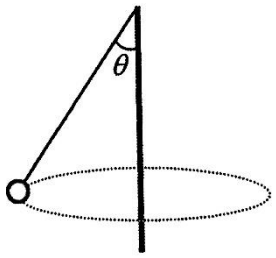

FIGURE 4.2

FIGURE 4.2 shows a 250 g bob suspended by a light string rotating in a horizontal circle of radius 30 cm with a linear speed of 2 m s^{-1}.

(i) Calculate the angle θ which the string makes with the vertical axis.

(ii) Calculate the tension in the string.

(iii) If the speed is increased, how would it affect the circular motion of the bob? Explain your answer .[6 *marks*]

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

(ii) Sketch the graphs of gravitational field strength, a_g and gravitational potential, V versus distance, r from the surface of the earth.

(iii) The period of the moon orbiting Pluto is 4.8 days. The radius of the orbit is $4 \times 10^7\ m$. Calculate the mass of Pluto. [7 *marks*]

5 (a) (i) Define instantaneous angular acceleration.

(ii) State three (3) factors which affect the moment of inertia of a rigid body. [3 *marks*]

(b) A flywheel with moment of inertia 8 kg m^2 is acted upon by a constant torque of 50 N m. Calculate the

(i) angular acceleration.

(ii) time for it to rotate from rest to 70 rad s^{-1}.

(iii) power when the angular velocity is 50 rad s^{-1}. [4 *marks*]

(c)

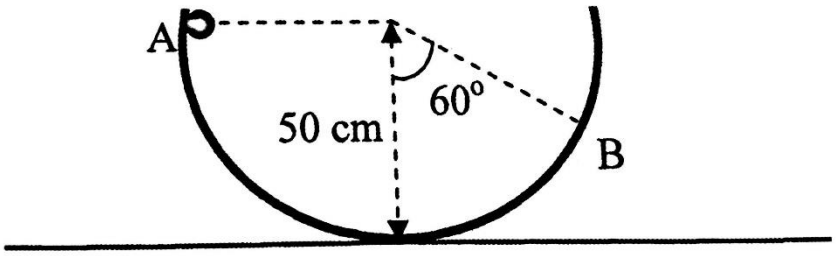

FIGURE 5.1

FIGURE 5.1 shows a tiny ball with mass , M is released from point A rolls without slipping on the inside surface of a hemisphere with radius of curvature 50 cm. The moment of inertia of the ball is $\frac{2}{5}MR^2$ where R is the radius of the ball. Calculate the speed of the ball at point B.

(d)

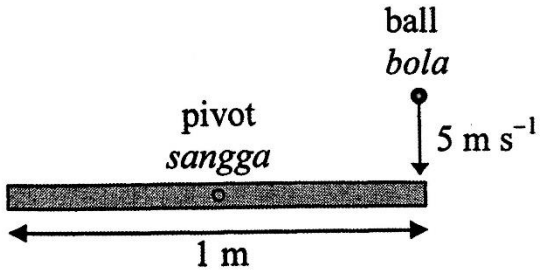

FIGURE 5.2

FIGURE 5.2 shows a top view of a 1m rod pivoted freely at its center and placed horizontally. A 20 g ball with velocity 5 m s^{-1} collides and stick at one end of the rod causing them to rotate. The moment of inertia of the ball –rod system is 0.02 kg m^2. Calculate the angular velocity of the rod.

6 (a) (i) What is meant by simple harmonic motion?

(ii) Is a bouncing ball an example of simple harmonic motion? Explain your answer. [2 *marks*]

(b) A particle in simple harmonic motion along the x-axis starts from the equilibrium position and moves towards the right with an amplitude of 2 cm and a frequency of 1.5 Hz.

(i) Write the simple harmonic equation of the particle.

(ii) Calculate the maximum speed of the particle.

(ii) Calculate the acceleration of the particle at t = 3.2 s.

[5 *marks*]

(c) A 50 g object connected to a spring with a spring constant 35 N m^{-1} ocillates with amplitude 4 cm on a horizontal frictionless surface. Calculate the

(i) total energy of the system.

(ii) speed of the object at displacement 1.6 cm.

(iii) change the period of the oscillation if a load of 6 g is added to the object. [*8 marks*]

7 (a) (i) Explain the formation of stationary wave.

(ii) A violin string has a mass per unit length of 0.01 kg m^{-1} and experiences a tension of 0.36 N. Calculate the wavelength of the string if it vibrates at a frequency of 8 Hz.

(iii) The first overtone standing wave is formed in a 30 cm closed pipe. Sketch the wave and calculate its frequency. The speed of sound is 340 m s^{-1}. [8 marks]

(b) (i) What is Doppler effect for sound wave?

(ii) A car is travelling at 25 m s^{-1} emits a sound of frequency 1100 Hz approaches a stationary observer. Calculate the apparent frequency of the sound heard by the observer. The speed of sound is 340 m s^{-1}.

[3 marks]

(c) A solid cylinder 10 m high and 10 cm in diameter is compressed by a

$1 \times 10^5\ kg$ load. Calculate the strain energy stored in the cyclinder. The Young's Modulus of cylinder is $1.9 \times 10^{11} Pa$. [4 marks]

8 (a) A 200 cm^3 glass cylinder is filled to the brim with mercury at 27^0 C. Calculate the amount of overflow when the temperature of the system increases to 100^0 C. The coefficient of linear expansion of the glass and mercury are $4 \times 10^{-6} K^{-1}$ and $6 \times 10^{-5} K^{-1}$ respectively. [4 *marks*]

(b) (i) Define the degree of freedom of gas molecules.

(ii) State the principle of equipartition of energy.

(iii) Two moles of a polyatomic ideal gas has volume of 0.05 m^3 at pressure 250 kPa. Calculate the internal energy and temperature of the gas. [6 *marks*]

(c)

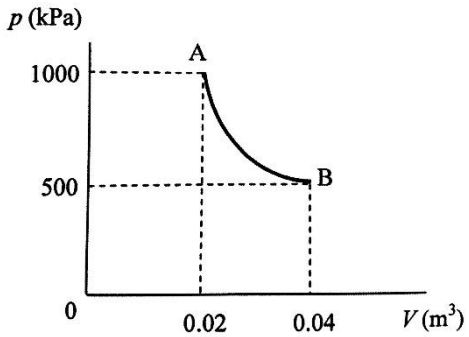

FIGURE 8

FIGURE 8 shows a p – V graph of an isothermal process at 600 K for two moles ideal gas in a cylinder with frictionless piston. If the internal energy at point A is 2.5×10^4 J, does the heat being absorbed or released during the process from A to B? Justify your answer.

[5 *marks*]