SF017/2
Physics
Paper 2
Semester I
Session 2010/2011
2½ hours

SF017/2
Fizik
Kertas 2
Semester I
Sesi 2010/2011
2½ jam

BAHAGIAN MATRIKULASI
KEMENTERIAN PELAJARAN MALAYSIA
MATRICULATION DIVISION
MINISTRY OF EDUCATION MALAYSIA

PEPERIKSAAN SEMESTER PROGRAM MATRIKULASI
MATRICULATION PROGRAMME EXAMINATION

FIZIK
Kertas 2
2 jam 30 minit

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

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

INSTRUCTIONS TO CANDIDATE:

This question booklet consists of **Section A** and **B**.

Answer **all** questions in **Section A**.

Answer **question 9** and **any three** questions in **Section B**. Only the **first four answers** in **Section B** will be evaluated.

Answers to both sections must be written in the answer booklet provided. Use a new page for each question.

The use of electronic calculator is permitted.

SECTION A [30 *marks*]

*Answer **all** questions in this section.*

1 A 50 g marble is released from a height of 1 m above the floor. Calculate its momentum just before hitting the floor.

[3 *marks*]

2

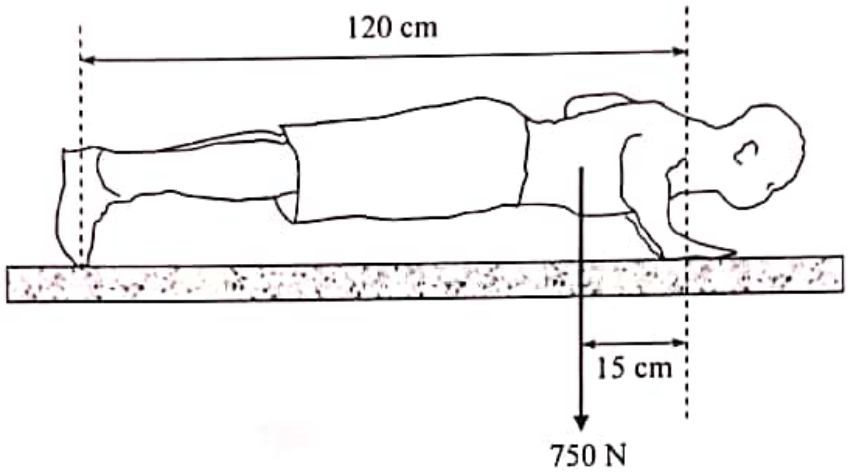

FIGURE 1

A 750 N athlete is doing a push-up exercise by putting his palms and toes on the floor as shown in **FIGURE 1**. The athlete's centre of mass is 15 cm from his palms. The horizontal distance between his toes and palms is 120 cm. Assume the posture of the athlete as a rigid body,

(a) draw a free body diagram of the athlete.

(b) calculate the force acting on each of his palms.

[4 *marks*]

3 A 0.2 kg ball, attached to the end of a string, is rotated in a horizontal circle of radius 1.5 m on a frictionless table surface. The string will snap when the tension exceeds 50 N.

(a) What is the maximum speed of the ball?

(b) If there were friction on the table, what will happen to the maximum speed of the ball? Explain your answer.

[4 *marks*]

4 (a) State **one** difference of the accelerations between linear motion and that of simple harmonic motion.

(b) A mass m at the end of a spring vibrates vertically with a frequency of 0.9 Hz. When an additional 1.2 kg is attached to m, the frequency is 0.5 Hz. Calculate the value of m.

[4 *marks*]

5 The equation of a progressive wave is given as

$$y = 2\sin(10t + 5x) \text{ cm}$$

where t is in second and x in cm. Determine the propagation velocity of the wave.

[4 *marks*]

6 A spring stretches by 4 mm when a 1.5 kg mass is suspended at its end. Calculate the spring constant.

[3 *marks*]

7 A closed kettle contains hot water.

(a) State **three** factors that influence the rate of radiative heat loss from the kettle.

(b) Will the rate of heat loss be increased, decreased or unchanged if the surface of the kettle is painted black? Explain your answer briefly.

[4 *marks*]

8 (a) Define molar specific heat at constant pressure.

(b) The root mean square (rms) speed of gas molecules is to be reduced by 1%. If the gas temperature is 27 °C, at what temperature does it should be cooled down?

[4 *marks*]

SECTION B [60 *marks*]

Answer ***question 9*** *and* ***any three*** *questions in this section.*

9 The period, T of a simple pendulum is given by

$$T = 2\pi\sqrt{\frac{l}{g}}$$

where l is the length of the string and g is the gravitational acceleration. In an experiment, the time for 20 oscillations for various lengths of string were measured and the results are shown in **TABLE 1**.

TABLE 1

Length of string, l (cm)	**Time for 20 oscillations (s)**	**Period, T (s)**	**T^2 (s^2)**
90.0	37.5		
80.0	36.0		
70.0	34.0		
60.0	31.5		
50.0	29.0		
40.0	26.5		
30.0	22.5		
20.0	19.0		

(a) Copy and complete **TABLE 1**. [4 *marks*]

(b) Plot a graph of T^2 versus l. [6 *marks*]

(c) Determine the gradient of the graph. [3 *marks*]

(d) Calculate the value of g using the gradient of the graph. [2 *marks*]

10 A drunken motorist who is moving at a constant velocity of 90 km h^{-1} passes a stationary police patrol car. The patrol car immediately gives chase at a constant acceleration and catches up with the motorist after a distance of 10 km.

(a) Calculate the time taken by the patrol car to catch up with the motorist.

[2 *marks*]

(b) Calculate the acceleration of the patrol car.

[3 *marks*]

(c) Calculate the velocity of the patrol car when it catches up with the motorist.

[3 *marks*]

(d) On the same axes, sketch and label graphs of displacement versus time for both vehicles.

[5 *marks*]

(e) Given the power of police car is 180 kW, calculate the force of the car's engine at the instant it overtakes the motorist.

[2 *marks*]

11

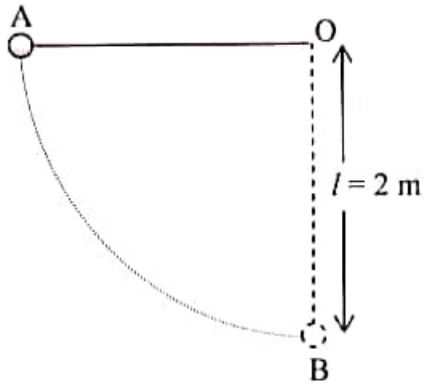

FIGURE 2

A small bob of mass 10 g is attached to the end of a massless string of length 2 m. The other end of the string is fixed at point O as shown in **FIGURE 2**. Initially the bob is held at point A which is at the same level as point O, keeping the string taut and then released. Determine

(a) the linear velocity of the bob at point B directly beneath point O.

[3 *marks*]

(b) the angular velocity of the bob at point B.

[2 *marks*]

(c) the tension of the string when the bob is at point B.

[4 *marks*]

(d) the linear velocity of the bob at a point midway through arc AB.

[3 *marks*]

(e) whether the linear velocity of the bob at point B be lower, higher or similar if the experiment is performed on the surface of the moon. Explain your answer briefly.

[3 *marks*]

12 (a) Two 40 cm steel wires of different diameters are stretched by equal tensional force of 200 N. The diameter of the first wire is 98% to that of the second wire. When the first wire is plucked, it produces a sound of 350 Hz. Calculate

(i) the mass per unit length of the first wire.

(ii) the mass per unit length of the second wire.

(iii) the frequency of the sound produced by the second wire when plucked.

(iv) the frequency of the beat produced when both wires are plucked together.

[12 *marks*]

(b) (i) Define sound intensity.

(ii) How does the intensity of sound change with the sound wave amplitude, A and distance, r from its source?

[3 *marks*]

13 (a) For two atoms,

(i) sketch a labeled graph of the interatomic potential energy, U against separation distance, r.

(ii) the interatomic potential energy is given by

$$U(r) = \frac{A}{r^{12}} - \frac{B}{r^{6}}$$

where A and B are empirical constants. Use the formula to derive the interatomic force, $F(r)$.

(iii) sketch a labeled graph of the interatomic force, F against separation distance, r using the same axes as the graph in **13**(a)(i).

[6 *marks*]

(b)

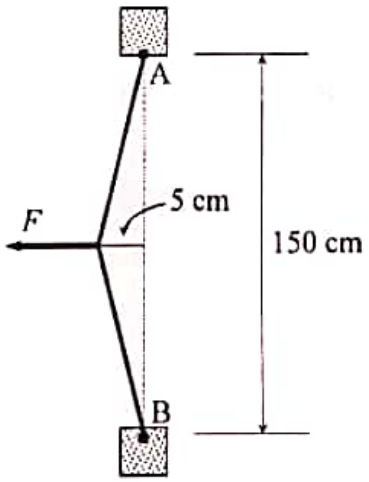

FIGURE 3

A steel wire AB, of length 150 cm and diameter 1 mm is fixed at both ends. A force F pulls the wire at the midpoint and causes a displacement of 5 cm as shown in **FIGURE 3**. If the Young modulus of the steel is 2 GPa, calculate the

(i) magnitude of F.

(ii) energy stored in the wire.

[9 *marks*]

14 (a) What is meant by the isothermal process?

[1 *mark*]

(b) One cubic meter air initially at 27 °C and atmospheric pressure is compressed isothermally to half of its original volume. Then the air is allowed to expand isobarically back to its original volume.

(i) Using the same axes, sketch and label a p-V diagram of these two thermodynamic processes.

(ii) Calculate the pressure of the air after the isothermal compression.

(iii) Calculate the final temperature of the air.

(iv) Calculate the total work done for the whole process.

[14 *marks*]

END OF QUESTION BOOKLET