PROGRAM KECEMERLANGAN UNIT FIZIK
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PRA PSPM 1

1. Show that the expression $v = at$ is dimensionally correct, where v, a and t represent the speed, acceleration and time interval of an object respectively.

[2 marks]

2. (a) A boy is driving with a velocity of 15.0 ms^{-1} and decelerates at a constant rate of 2.0 ms^{-2} until his car stops completely.

(i) Sketch a velocity-time graph for this motion.

(ii) Calculate the distance travelled by him.

[5 marks]

(b) A water rocket was launched at an angle 60º from horizontal with a speed of 30 m s^{-1}. After the water is used up and the rocket reached maximum height, it falls and lands back. Calculate the

(i) maximum height of the ball.

(ii) range of the rocket.

[5 marks]

3. (a)

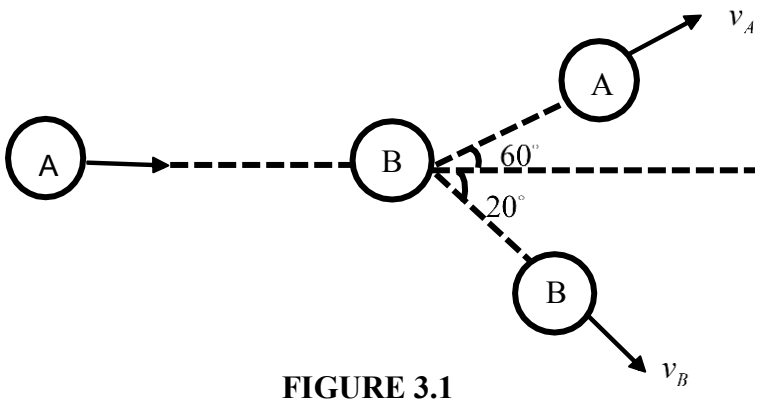

FIGURE 3.1

Object A is moving with velocity 40 m s^{-1} collide with object B at rest. Both of the object has the same mass. After the collision, both objects move in different direction as shown in **FIGURE 3.1**. Calculate the magnitude of velocity of both object after the collision.

[5 marks]

(b)

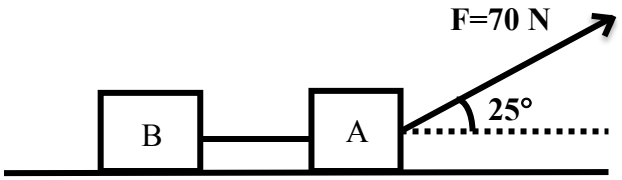

FIGURE 3.2

Box A of mass 30 kg is connected to box B by rope on a rough horizontal surface and pulled by force of 70 N as shown in **FIGURE 3.2**. The boxes are moving with a constant velocity. Angle between force, F and the horizontal surface is 25º. Coefficient of kinetic friction between the surface and the boxes is 0.05.

(i) Draw two separate free body diagrams which shows all the forces acting on block **A** and **B**.

(ii) What is the value of tension acting on the rope connecting block **A** and **B**?

(iii) What is the mass of block **B**?

[8 marks]

4. (a) A 450 kg piano slides 3.8 m down a 27° incline plane and is kept from accelerating by a man who is pushing back on it parallel to the inclined plane. The coefficient of kinetic friction between the piano and the plane is 0.40. Calculate the work done by the frictional force.

[4 marks]

(b) A horizontal spring attached to a wall has a force constant of 850 N m^{-1}. A block of mass 1.50 kg is attached to the spring and rests on a frictionless horizontal spring. The block is pulled to a position of 6.00 cm from equilibrium and released. Calculate the speed of the block as it passes through the equilibrium point.

[2 marks]

(c) A 7500 W engine is propelling a boat at 12 km h^{-1}. Determine the force exerting in the boat.

[2 marks]

5. A car with mass of 1500 kg moves with constant speed along a horizontal curve of radius 70.0 m. The coefficient of static friction between the road and the tires is 0.72. Calculate the

(i) centripetal force acts on the car.

(ii) maximum speed of the car without skidding.

[5 marks]

6. (a) A 1.50 kg mass on a spring has displacement as a function of time given by the equation $y = 5.60 \sin 4.38t$ where y in cm and t in seconds. Find the

(i) time for one complete vibration.

(ii) force constant of the spring.

(i) maximum speed of the mass.

(iv) position, speed, and acceleration of the mass at t = 1.00 s.

[12 *marks*]

(b) A transverse sine wave with an amplitude of 3.50 mm and a wavelength of 1.60 m travels from left to right along a long, horizontal, stretched string with a speed of 30 ms^{-1}. Take the origin at the left end of the undisturbed string. At time t = 0, the left end of the string has no upward displacement. Determine the

(i) frequency, angular frequency, and wave number of the wave.

(ii) displacement equation for the wave.

(iii) displacement equation for a particle at $x = 0$.

(iv) displacement equation for a particle $x = 1.40$ m.

(v) maximum magnitude of transverse velocity of any particle of the string.

(vi) transverse displacement and the transverse velocity of a particle 1.40 m to the right of the origin at time $t = 0.05$ s.

[11 *marks*]

7. (a) A steel wire of diameter 3.3 mm and 40 cm long is attached to a mass of 2.5 kg at one end and is suspended. The wire elongates by 0.1 mm. Calculate the

(i) Young's Modulus.

(ii) energy stored in the wire.

[5 marks]

(b)

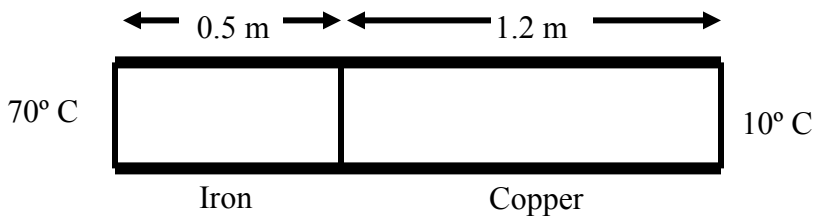

FIGURE 7

FIGURE 7 shows an iron-copper composite rod of length 1.7 m with same area insulated along its sides. At steady state, the temperatures at their ends are 70° C and 10° C respectively. Calculate the temperature at the interface area between iron and copper rod.
Given thermal conductivity of iron and copper are 40 $Wm^{-1}K^{-1}$ and 360 $Wm^{-1}K^{-1}$ respectively.

[3 marks]

8. (a) The internal energy of two molecules of helium gas is 1.56×10^{-20} J. The volume of helium gas in a container is 200 cm^3. Calculate the root mean square speed for helium gas.
(Given the molar mass of He is 4.00 g mol^{-1}).

[4 marks]

(b) Two mole of an ideal gas is expanded isothermally from V to 4V. The work done by the gas is 5.6×10^3 J.

(i) Sketch a P-V graph for this process.

(ii) Calculate the heat transferred during the expansion. Is the heat absorbed or released by the system?

(iii) What is the temperature of the gas?

[7 marks]

2) a ii) 56.25m b i) 34.40m ii) 79.5m

3) a) $V_A = 13.89\ ms^{-1}$, $V_B = 35.17\ ms^{-1}$ b) ii) 50.21N iii) 102.37 kg

4) 3.93×10^3 N, -5.97×10^3 J b) $1.43\ ms^{-1}$ c) 2.25×10^3 N

5) (i) 1.06×10^4 N ii) $22.24\ ms^{-1}$

6) a i) 1.43 s, ii) $28.78\ Nm^{-1}$, iii) $0.245\ ms^{-1}$,
iv) -5.29×10^{-2}, $-7.99 \times 10^{-4}\ ms^{-1}$, $1.02\ ms^{-1}$

6 b) i) 18.75 Hz , 117.81 rad s^{-1} , 3.93 m^{-1}

iv) 0.41 ms^{-1}. vi) 1.34×10^{-3} m, 0.381 ms^{-1}

7 a) i) 1.15×10^{10} Nm^{-2} ii) 1.23×10^{-7} J

b) 21.63 °C

8 a) 376.8 K , 1532.5 ms^{-1}

b) ii) 5.6×10^{3} J iii) 243.1 K