INTI International College Penang

FINAL
Alternative Assessment

(COVER PAGE)

Session	:	**April 2021**
Programme	:	Foundation in Science (CFSI)
Course	:	**PHY1205: Physics 1**
Date of Examination	:	29 July 2021 (Thursday)
Time	:	9:00am – 11:30am Reading Time : Nil
Duration	:	2 hours + 30 minutes (uploading time)
Special Instructions	:	

This paper consists of **FOUR (4)** questions. Answer all questions.

Materials permitted :

Non-Programmable Scientific Calculator

Materials provided :

Nil

Examiner(s)	:	**Dr. Adele Kam**
Moderator	:	Ms. Ng Wing Mei

*This paper consists of **6** printed pages, including the cover page.*

FOUNDATION IN SCIENCE (CFSI)
PHY1205: PHYSICS 1
FINAL ALTERNATIVE ASSESSMENT: APRIL 2021 SESSION

Instructions: This paper consists of **FOUR (4)** questions. Answer all questions.

Question 1

(a) (i) A nanoparticle has a diameter of 12 nm. Assuming it is spherical, determine its surface area in micron units. (3 marks)

(ii) A cheetah is running at an acceleration of 9 m/s^2. What is its acceleration in $yards/min^2$? (Given 1 yard = 0.9144 m) (3 marks)

(b) A rocket was launched with a velocity of 60 m/s from ground level and its engines accelerated it at 4.0 m/s^2 until it reached an altitude of 1000 m. At that point, the engines fail and the rocket goes into free-fall motion (it continued traveling upwards a certain height before falling back to the ground). Disregard air resistance. How long was the rocket above ground? (8 marks)

(c) Three forces acting on an object are represented by the force diagram in Figure 1(c). Determine the net force acting on this object given in unit vector notation.

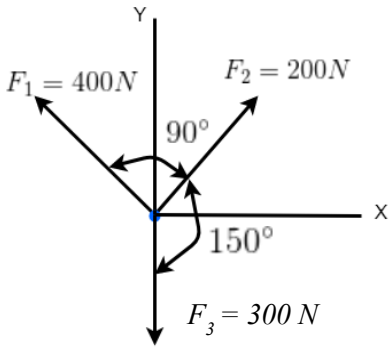

Figure 1(c) (6 marks)

(d) A ball was kicked off a cliff with an initial horizontal velocity of 8 m/s as shown in Figure 1(d). Time elapse during the motion is 5 s. Determine the magnitude and direction of the velocity of this ball just before it hits the ground.

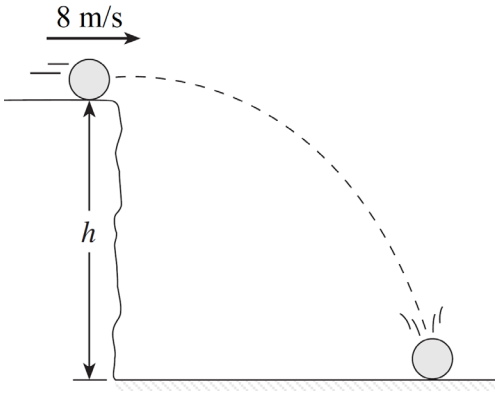

Figure 1(d) (5 marks)

Question 2

(a) The system depicted in Figure 2(a) is released and slides down a frictionless inclined plane. Determine the acceleration of the system and the magnitudes of the tensile forces, T_1 and T_2, acting upon the strings. Given $m_1 = 2.5$ kg, $m_2 = 4.0$ kg and $m_3 = 3.0$ kg. The inclined plane has a slope of angle $\alpha = 30^o$. Ignore the mass of the rope and assume the pulley is frictionless.

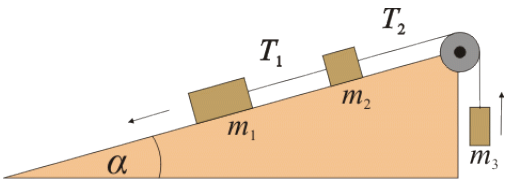

Figure 2(a) (8 marks)

(b) A 5.0 kg box is pulled by a force of 20 N at an angle of 30° above the horizontal as shown in Figure 2(b). The box is on a rough horizontal plane. Given that the box is at the point of slipping, what is the coefficient of friction between the box and the plane?

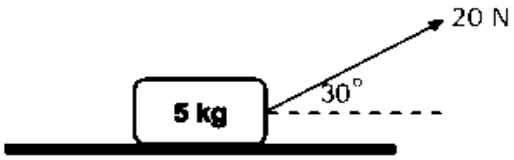

Figure 2(b) (5 marks)

(c) A 3.0 kg block starts at point A and moves along a horizontal frictionless surface with a speed of 12.0 m/s. At point B, it starts to move up a slope that is 2.5 m in length, with coefficient of kinetic friction, $\mu_k = 0.20$. The slope is at an angle $\theta = 35^o$. At the top of the slope, it then continues to point C on another frictionless surface. Determine the work done by friction and the velocity of the block at point C.

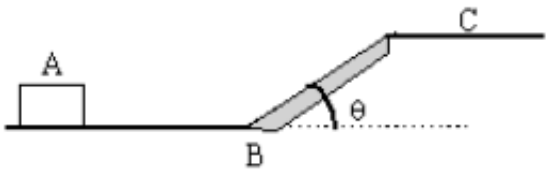

Figure 2(c) (7 marks)

(d) A boy runs with a horizontal velocity of 4.0 m/s and hops onto a stationary swing. He clings onto the swing and swings forward. The boy's mass is 25 kg and the mass of the swing is 3.0 kg.

(i) Determine the boy's horizontal velocity just after hopping onto the swing. (2 marks)

(ii) How high does the boy and swing rise? (3 marks)

Question 3

(a) A lacrosse bat, 1.2 m in length, is rotated through an angle of 90°, releasing the ball when the bat is at a vertical position, as shown in Figure 3(a). The bat is at rest when horizontal, and the ball leaves the stick with a velocity of 10 m/s. What angular acceleration must the lacrosse bat experience?

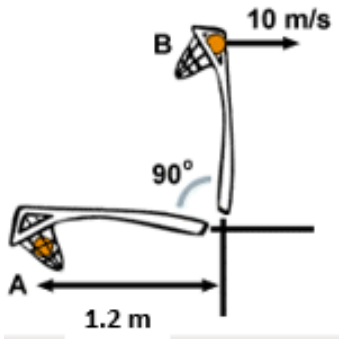

Figure 3(a) (4 marks)

(b) A 1.2 kg mass initially at rest, is accelerated into a circular motion by a torque. The mass moves in a circular path of radius of 2 m and completes a full revolution in 0.8 s. The moment of inertia of the object is mr^2. Determine the work done by the torque over this full revolution. (5 marks)

(c) A 600 kg satellite orbits around a planet. The gravitational potential energy of the satellite is -5.1×10^9 J and the mass of the planet is 3.8×10^{23} kg. Determine for the satellite, its

(i) orbital radius (2 marks)

(ii) orbital speed (2 marks)

(iii) kinetic energy (2 marks)

(iv) total energy (2 marks)

(d) A weighing scale shows a reading of 10.4 kg when a certain object is weighed in air and 8.6 kg when the object is fully immersed in water.

(i) Determine the density of this object. (4 marks)

(ii) What would the reading on this weighing scale be when the material is fully immersed in ethanol, with a density of 785 kg/m^3? (4 marks)

Question 4

(a) An object's oscillation on a spring is described by the following function:

$$x = 5\cos\left(1.7t + \frac{\pi}{6}\right)$$

where distance is measured in meters and time in seconds. The object has a mass of 1.32 kg. Determine the

(i) equation of the velocity of this object. (2 marks)

(ii) equation of the acceleration of this object. (2 marks)

(iii) spring constant. (2 marks)

(iv) total energy of this system. (2 marks)

(b) A travelling wave on a string is described by the following equation:

$$y = 0.04\sin\left(0.42x - 55t + \frac{\pi}{4}\right)$$

where x and y are expressed in meters and t is in seconds. The string has a linear density, $\mu = 0.020$ kg/m. Determine the

(i) speed of the wave. (6 marks)

(ii) tension in the string. (2 marks)

(c) A square 3 cm x 3 cm iron plate is heated to a temperature of 200 ^{o}C from a room temperature of 27 ^{o}C. Determine the final area of this plate given that the coefficient of linear expansion of iron is 1.1 x 10^{-7} $^{o}C^{-1}$. (3 marks)

(d) A couple of hours after a volcanic eruption, the lava that was spewed has stopped flowing and is slowly cooling. The interior temperature of the lava is at 1000^{o}C while its surface temperature is at 400^{o}C. The ambient temperature is at 30^{o}C.

(i) Assuming the emissivity is 0.95, determine the net rate of energy exchange due to thermal radiation from 1.00 m^2 of surface lava into its surroundings. (3 marks)

(ii) Assuming that the lava has a conductivity of 0.88 $Wm^{-1}K^{-1}$, determine the thickness of the lava between the surface and the interior layers. Assume heat conduction to the surface occurs at the same rate as in part (i). (3 marks)

~ The End ~