

FINAL
Alternative Assessment

(COVER PAGE)

Session : April 2022

Programme : Foundation in Science (CFSI)

Course : PHY1205: Physics 1

Date of Examination : 4 August 2022 (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 in the answer booklet provided.
All questions carry equal marks.

Materials permitted :
Non-programmable calculator

Materials provided :
Nil

Examiner(s) : Mr. Dinash Kandasamy

Chief Moderator : Dr. Ley Hood Hong

This paper consists of 4 printed pages, including the cover page.

FOUNDATION IN SCIENCE (CFSI)
PHY1205: PHYSICS 1
FINAL EXAMINATIONS: APRIL 2022 SESSION

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Question 1

a) Complete the table

	BTU	kCal	kJ
Energy required to raise the temperature of 300 grams of water by 2°C			

It takes 4200 J of energy to raise the temperature of 1 kg of water by 1°C. [7 marks]

b) A steel ball falls freely from a cliff 150 m above a flat bottomed pond. The ball decelerates at 0.5g once it is in the water. The ball then hits the bottom of the pond 4.2 seconds after entering the pond. How deep is the pond? [7 marks]

c) A bumper car goes from point A with position vector $(7\vec{i} - 3\vec{j} - 6\vec{k})$ m to point B, with position vector $(-2\vec{i} + 5\vec{j} - 4\vec{k})$ m in 4.4 seconds. The magnitude of velocity at point A is 4 m/s. Determine in \vec{i}, \vec{j} and \vec{k} form the

- velocity at A, [4 marks]
- acceleration, [4 marks]
- velocity at B. [3 marks]

Question 2

a) A ball is rolled off an elevated platform 120 m above ground level at a speed of 22 m/s. Determine the

- time taken for the ball to land on the ground, [2 marks]
- horizontal distance travelled by the projectile. [1 mark]
- velocity of the ball just before it lands on the ground [4 marks]

b) A train engine pulls one car up a 25° incline with acceleration 3 m/s² as shown in Fig. 2(b). The mass of the engine and the car is 10000 kg and 9700 kg respectively. Determine the force exerted by the engine and the tension in the link. [4 marks]

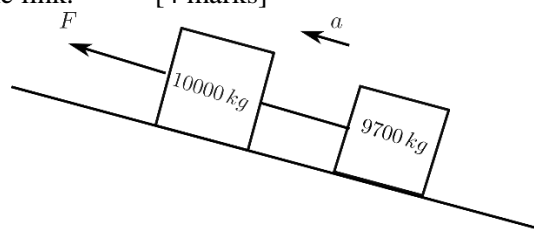
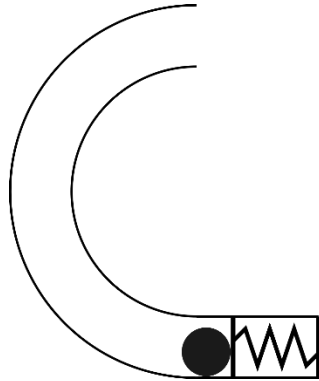


Fig. 2(b)

- c) A 1500 kg car drives over a small hill with radius, $r = 150$ m at a constant speed, v .
- Determine the maximum speed in m/s for the car to clear the hill safely.
[4 marks]
 - What is the maximum speed for a lorry of mass 4500 kg to be able to clear the hill safely?
[2 marks]
 - Assuming the coefficient of friction between the tyres and the road is 0.2. What is the frictional force at the top of the hill when car is travelling at the maximum speed?
[1 mark]
- d) A spring is used to propel a 30 gram steel ball along a rough circular path with radius, $R = 1$ m. The mechanism is shown in Fig. 2(d). The spring has spring constant 900 N/m. The ball only goes halfway up the circular path when the spring is compresses by 7 cm and released . Determine
- the average frictional force [3 marks]
 - the minimum compression for the ball to exit the circular path [4 marks]

**Fig. 2(d)****Question 3**

- a) A 1000 kg and 1450 kg moving at speed 190 m/s and 220 m/s collide head on. The collision causes the masses to fuse and break into two masses each with mass 1250 kg and 1200 kg. The 1200 kg mass moves at speed 130 m/s with angle 33° from the original path of the 1000 kg mass. Determine
- velocity of the 1250 kg mass [5 marks]
 - the change in kinetic energy before and after the collision [2 marks]
- b) A wrench has an adjustable handle whose length can be varied from 15 cm to 35 cm. The mass of the wrench is 380 grams and its centroid is quarter its length from the pivot. If the user can only apply 100 N at $5/9$ ths the length of the wrench from the pivot. Determine
- the maximum torque that can be applied with aid of a diagram, [4 marks]
 - length of the wrench if user wishes to apply 18 Nm [3 marks]
- c) An average basketball jumps about 80 cm to be able to touch the basketball rim. Determine how much higher/lower the rim should be in a planet with half the radius of earth but with same mass. Assume that gravitational pull near the surface of the planet is constant. [7 marks]

- d) Three liquids A, B and C with density 13600 kg/m^3 , 5800 kg/m^3 and 2400 kg/m^3 were poured into one end of an U tube one by one. Liquid A is poured first, followed by liquid B and liquid C. The height of liquid B and C in the U tube is 6 cm and 7 cm respectively. Sketch the diagram, mark the liquids and determine the column height of liquid A w.r.t the base of liquid B. [4 marks]

Question 4

- a) A cylinder with length 8 m and diameter 1.5 m is partially submerged and upright in water. The density of the cylinder is 90% that of water. Determine the amount of mass that can be added to the top of the cylinder before it is completely submerged. Take density of water as 1000 kg/m^3 . [4 marks]
- b) A spring mass system with mass, $m = 150 \text{ kg}$ and spring constant, $k = 500 \text{ kN/m}$, is stretched 4 cm from its equilibrium position and then released. Determine the
- the frequency and period of oscillation [3 marks]
 - the change in mass if the period increases by 25% [4 marks]
- c) A 5 m long string with mass 25 grams, is stretched taut with a 300 N force. Determine the
- linear density of the string, [1 marks]
 - wave speed in the string, [2 marks]
 - wavelength of the fundamental frequency, [2 marks]
 - frequency of the fundamental frequency. [2 marks]
- d) Two aluminium components are bolted together using a copper pin. The diameter of the pin is 5.02 mm and the diameter of the hole is 5.00 mm. Given the thermal expansion coefficient of titanium $17 \times 10^{-6} \text{ }^\circ\text{C}^{-1}$ and aluminium $20 \times 10^{-6} \text{ }^\circ\text{C}^{-1}$. Determine the temperature when the components will separate. [7 marks]

-- THE END --
PHY1205(F)/April2022