Fomenky's

UNIVERSITY OF BUEA
COLLEGE OF TECHNOLOGY
FIRST SEMESTER CONTINUOUS ASSESSMENT 2017/2018

COURSE INSTRUCTOR: MIH T./Nkongho A.
MONTH: February
COURSE CODE & NUMBER: EEC 211
YEAR: 2018
COURSE TITLE: PHYSICS 1
DATE: 08/02/2018
TIME:
TIME ALLOWED: Two Hours
CREDIT VALUE: 3

INSTRUCTIONS: Answer ALL questions. Begin each section on a new page. Where necessary, take m_p to be 1.67×10^{-27} kg, m_e to be 9.11×10^{-31} kg, $k_e = 9.0 \times 10^9$ N.m^2/C^2, G = 6.67×10^{-11} N.m^2/ kg^2.

SECTION I: ELECTROSTATICS

I. In the classical model of the hydrogen atom, the electron revolves around the proton with a radius of $r = 0.53 \times 10^{-10}$ m. The magnitude of the charge of the electron and proton is $e = 1.6 \times 10^{-19}$ C

(a) What is the magnitude of the electric force between the proton and the electron?

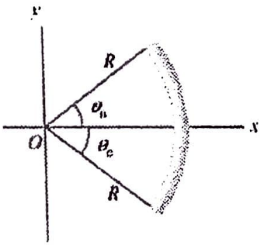
(b) What is the magnitude of the electric field due to the proton at r?

(c) What is ratio of the magnitudes of the electrical and gravitational force between electron and proton? Does the result depend on the distance between the proton and the electron?

(d) In light of your calculation in (b), explain why electrical forces do not influence the motion of planets.

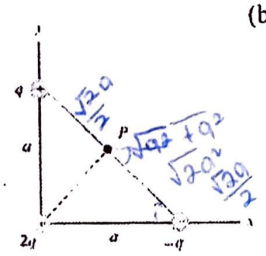
II. Answer EITHER

(a) A thin rod with a uniform charge per unit length λ is bent into the shape of an arc of a circle of radius R. The arc subtends a total angle $2\theta_0$, symmetric about the x-axis, as shown in the Figure to the right.. What is the electric field $\vec{E}$ at the origin O?



OR

(b) A right isosceles triangle of side a has charges q, $+2q$ and $-q$ arranged on its vertices, as shown below. What is the electric field at point P, midway between the line connecting the $+q$ and $-q$ charges? Give the magnitude and direction of the electric field.



III. Two tiny conducting balls of identical mass m and identical charge q hang from nonconducting threads of length l. Each ball forms an angle θ with the vertical axis, as shown in Figure 2.15.9. Assume that θ is so small that $\tan\theta \approx \sin\theta$. Show that, at equilibrium, the separation between the balls is

$$r = \left(\frac{q^2 l}{2\pi\varepsilon_0 mg}\right)^{1/3}$$

If $l = 1.2 \times 10^2$ cm, $m = 1.0\ 10^1$ g, and $x = 5.0$cm, what is q?

SECTION B

Q1a. State Newton's laws of motion

b. An object moves along the x axis according to the equation $x(t) = (6t^2 - 3t + 2)$ m. Determine (i) the average speed between $t = 2$s and $t = 3$s, (ii) the instantaneous speed at $t = 2$s and at $t = 3$s, (iii) the average acceleration between $t = 2$s and $t = 3$s, and (iv) the instantaneous acceleration at $t = 2$s and $t = 3$s.

c. An inquisitive physics student and mountain climber climbs a 60m cliff that overhangs a calm pool of water. He throws two stones vertically downward, 1s apart, and observes that they cause a single splash. The first stone has an initial speed of 3m/s. (i) How long after release of the first stone do the two stones hit the water? (ii) What initial velocity must the second stone have if they are to hit simultaneously? (iii) What is the speed of each stone at the instant the two hit the water?

d. Two blocks of mass 3.5-kg and 8-kg are connected by a massless string that passes over a frictionless pulley (Figure 1). The inclines are frictionless. Find (i) the magnitude of the acceleration of each block and (ii) the tension in the string.

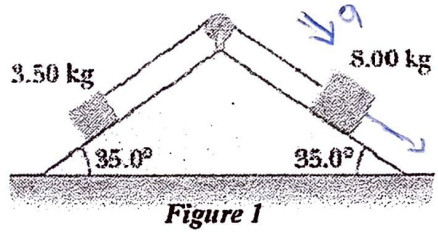


Figure 1

2a. State the following:

i) The principle of conservation of linear momentum.

ii) Newton's law of Gravitation.

b. The free-fall acceleration on the surface of the Moon is about one sixth of that on the surface of the Earth. If the radius of the Moon is about $0.250RE$, find the ratio of their average densities, ρ_{Moon}/ρ_E

c. A wheel 2.00 m in diameter lies in a vertical plane and rotates with a constant angular acceleration of 4.00 rad/s^2. The wheel starts at rest at $t = 0$, and the radius vector of a certain point P on the rim makes an angle of 57.3° with the horizontal at this time. At $t = 2.00$ s, find (i) the angular speed of the wheel, (ii) the tangential speed and the total acceleration of the point P, and (iii) the angular position of the point P.

d. An object of mass 3-kg, moving with an initial velocity of 5**i** m/s, collides with and sticks to an object of mass 2-kg with an initial velocity of -3**j** m/s. Find the final velocity of the composite object.

END