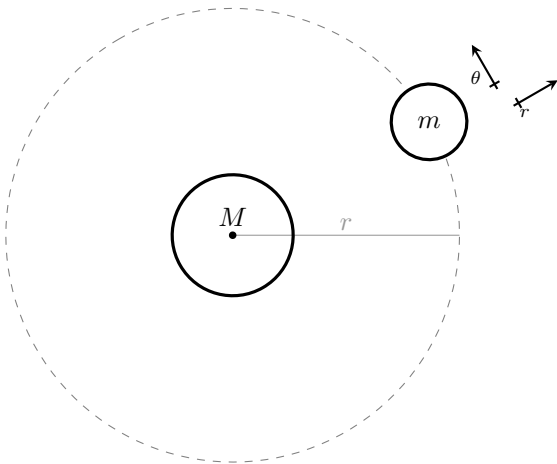


Exam 1



$$F_g = \frac{mMG}{r^2}$$

Description	Symbol	Quantity
Gravitational Constant	$G$	$6.67 \times 10^{-11} \text{N}\cdot\text{m}^2/\text{kg}^2$
Mass of Earth	$m_{\text{earth}}$	$5.98 \times 10^{24} \text{kg}$
Mass of Moon	$m_{\text{moon}}$	$7.36 \times 10^{22} \text{kg}$
Radius of Earth	$R_{\text{earth}}$	$6.38 \times 10^6 \text{m}$
Radius of Moon	$R_{\text{moon}}$	$1.74 \times 10^6 \text{m}$
Orbital Radius of Earth	$r_{\text{earth}}$	$1.50 \times 10^{11} \text{m}$
Orbital Radius of Moon	$r_{\text{moon}}$	$3.84 \times 10^8 \text{m}$
Period of Earth's Orbit	$T_{\text{earth}}$	365.24 days
Period of Moon's Orbit	$T_{\text{moon}}$	27.3 days

Table 1: A list of physical quantities.

The first question of the exam is worth 30 points. The above table is required.

1) Consider the earth moving around the sun.

a. Determine the orbital angular velocity of the earth.

$$(2 \cdot 3.14) / T$$

b. Determine the speed of the earth relative to the sun.

c. Determine centripetal acceleration of the earth relative to the sun.

$$a_{cent} = \frac{v^2}{r}$$

$$a_{cent} = \frac{29866^2}{1.5 \times 10^{11}}$$

$$a_{cent} = 5.95 \times 10^{-3} \frac{m}{s^2}$$

d. Determine the net force on the earth considering this acceleration.

e. Determine the mass of the sun from the above.

$$\frac{mMG}{r^2} = m * a$$

$$M = \frac{3.56 \times 10^{22} * (1.5 \times 10^{11})^2}{5.98 \times 10^{24} * 6.67 \times 10^{-11}}$$

$$M = 1.9 \times 10^{30} Kg$$

The second question is worth 30 points. The table is required.

**2)** Consider gravitation at the surface of the moon.

a. Determine the acceleration due to gravity on the surface of the moon.  $MG/r^2 = 7.36 * 10^{22} * 6.67 * 10^{-11}a = 1,62(m/r^2)$

b. Determine the launch velocity for circular orbit.

c. Determine the launch velocity for escape from the moon's gravity.

$$v_{escape} = \sqrt{2} * 1707.77$$

$$v_{escape} = 2415 \frac{m}{s}$$

d. Determine the result of launching an object at 2000 m/s into the moon's horizon.

it will go in the shape of an elliptical orbit.

Question three is worth 40 points.

**3)** Consider a capacitor. Two very large parallel conducting plates are connected to the leads of a 9 Volt battery.

a. Determine the separation between the plates to generate a  $30.0 \frac{\text{N}}{\text{C}}$  electric field.  $30=9/r$   $r= 0.3 \text{ (m)}$  ) b.

Determine the force of this electric field on a  $0.012 \text{ Coulomb}$  charge.  $F_e= q \cdot E= 0.012 \cdot 30 = 0.36 \text{ N}$  c. Determine the

change in potential energy for the  $0.012 \text{ C}$  charge moving from the  $9\text{V}$  plate to the  $0\text{V}$  plate. PE at  $0\text{Volt}= 0$

PE at  $9\text{Volt}= 0.012 \cdot 9=0.108 \text{ J}$

Change in PE =  $-0.108 \text{ J}$

d. Draw the parallel plates and the electric field between them.  $0\text{V} \text{---} 0.3\text{m} \text{---} 9\text{V}$