

First Name: _____

Last Name: _____

LO2 - FQ - Gravitational force

Q1: Two objects each have a mass of 30,000kg. If the gravitational force of attraction between the two objects is $5 \times 10^{-12} \text{N}$, then the distance between them is $a.bc \times 10^d \text{m}$, where a , b , c , and d are __, __, __, and __. (1 mark)

(Record your four digit answer in the Numerical Response boxes below)

| | | | |
|---|---|---|---|
| 1 | 1 | 0 | 5 |
|---|---|---|---|

$$F_g = \frac{Gm_1m_2}{r^2} =$$

$$5 \times 10^{-12} \text{N} = \frac{(6.67 \times 10^{-11})(30,000)(30,000)}{r^2}$$

$$(5 \times 10^{-12})r^2 = 0.06003$$

$$r^2 = 1.2006 \times 10^{10}$$

$$r = 109571 \text{m}$$

$$\approx 1.10 \times 10^5 \text{m}$$

$$a.bc \times 10^d$$

Q2: The gravitational force between two masses, m_1 and m_2 , located a distance r from each other, is F . What is the gravitational force if each mass is doubled and the distance between the masses is halved?

(1 mark)

- a) $\frac{1}{2}F$
- b) F
- c) $2F$
- d) $4F$
- e) $8F$
- f) $16F$

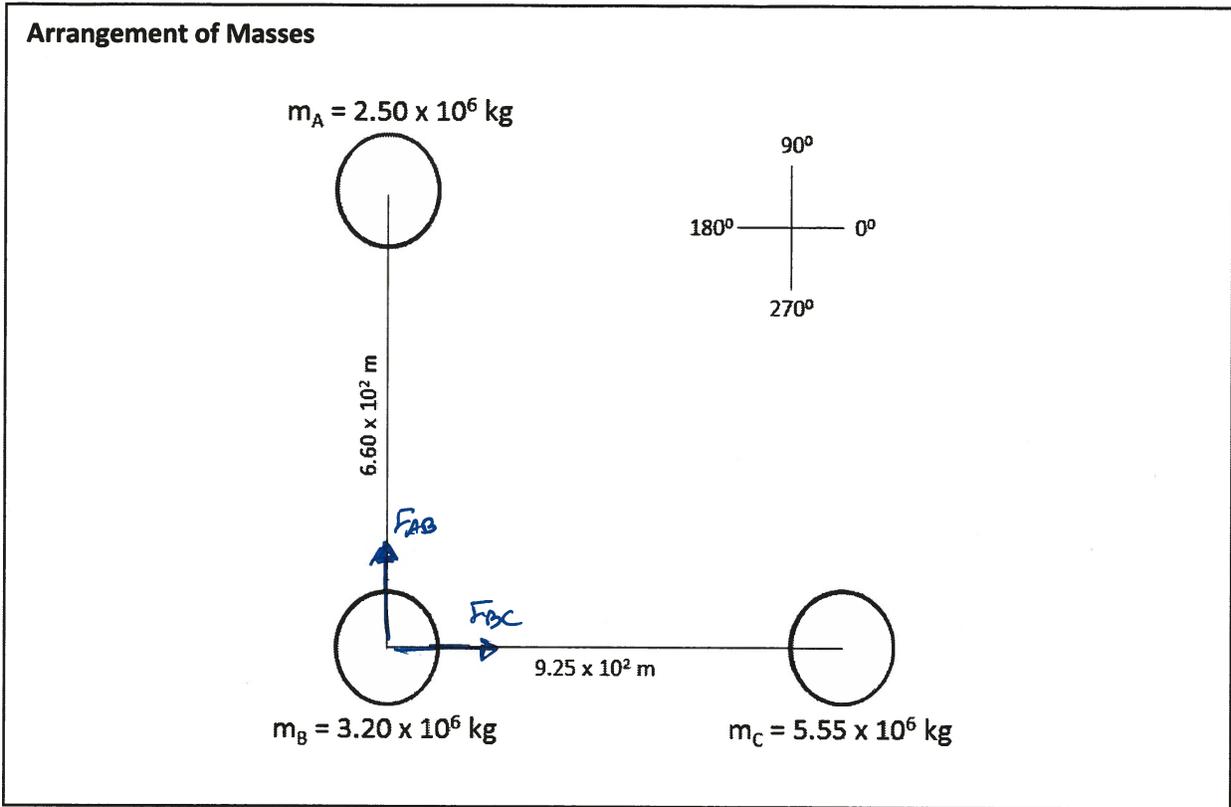
$$F_{\text{original}} = \frac{Gm_1m_2}{r^2}$$

$$F_{\text{new}} = \frac{G(2m_1)(2m_2)}{(\frac{1}{2}r)^2} = \frac{4Gm_1m_2}{\frac{1}{4}r^2}$$

$$= 16 \frac{Gm_1m_2}{r^2} = 16 \left(\frac{Gm_1m_2}{r^2} \right)$$

$$= 16(F_{\text{original}})$$

Use the following information to answer Q3:



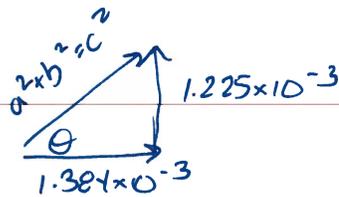
Q3: What is the acceleration of Mass B? (4 marks)

Marking Key:

- 1 mark – Finding F_{AB}
- 1 mark – Finding F_{BC}
- 1 mark – Finding F_{NET} (magnitude and direction)
- 1 mark – Finding acceleration (magnitude and direction)

$$F_{AB} = \frac{Gm_A m_B}{r^2} = 1.225 \times 10^{-3} \text{ N}$$

$$F_{BC} = \frac{Gm_B m_C}{r^2} = 1.384 \times 10^{-3} \text{ N}$$



$$|\vec{F}_{net}| = 1.85 \times 10^{-3} \text{ N}$$

$$\theta = 41.5^\circ$$

$$\boxed{\vec{F}_{net} = 1.85 \times 10^{-3} \text{ N } [41.5^\circ]}$$

MARKING:

| | |
|-------------|-----------|
| Beginning | 0.0 – 2.5 |
| Progressing | 3.0 – 4.0 |
| Competent | 4.5 – 5.5 |
| Exemplary | 6.0 |