**2.** *y*-direction.

momentum in *y*-direction = .....

.....kg m $s^{-1}$ [1]

**(ii)** Applying the principle of conservation of momentum in both directions, determine the momentum $p_e$ of the electron after the collision.

momentum $p_e$ of the electron = ..... kg m $s^{-1}$ [3]

[Total: 6]

**2** **(a)** State Newton's law of gravitation.

.....

.....

.....[2]

**(b)** Fig. 2.1 shows a hypothetical stable three-body system. The system comprises of three identical masses A, B and C orbiting about a common centre of rotation O.

The radius of orbit is $7.60 \times 10^8$ m.

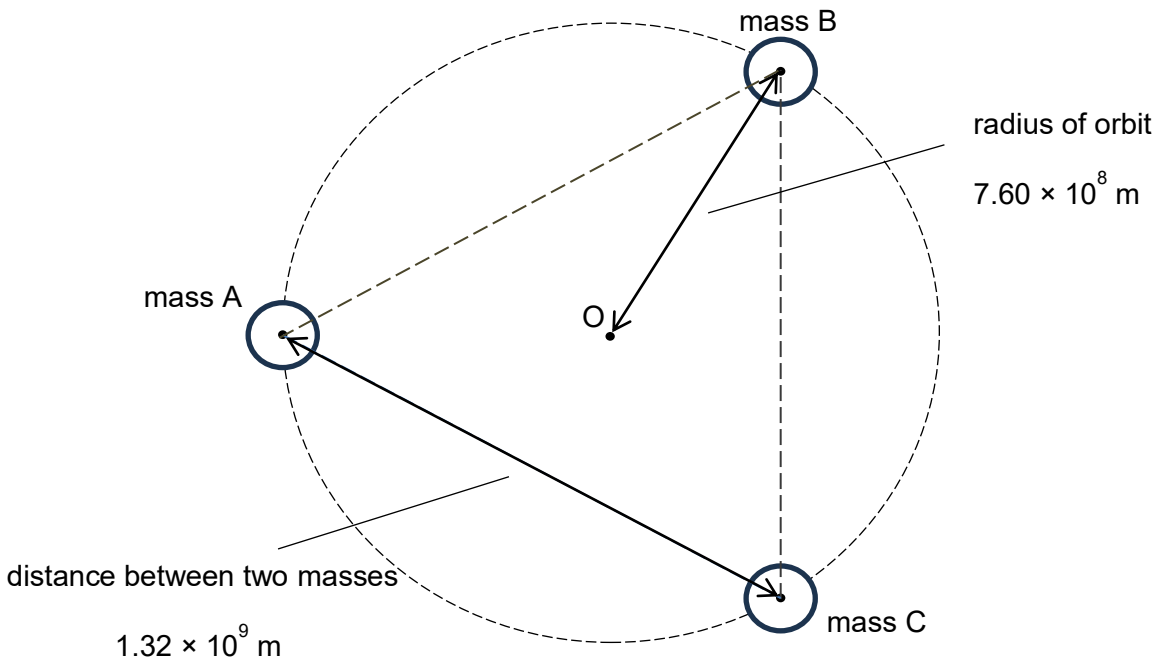


**Fig 2.1**

The masses are equally distributed along the circular path of orbit, such that the distance between any two masses is always the same.

The distance between the centres of any two masses is $1.32 \times 10^9$ m. Each mass is $6.20 \times 10^{24}$ kg.

**(i)** Show that the resultant force on mass A is $2.55 \times 10^{21}$ N.

[2]

**(ii)** Hence, calculate the period of orbit of the three masses about O. Explain your working.

period = ..... s [3]

**(iii)** Explain why gravitational potential near this system of three masses is always negative.

.....

.....

.....

..... [2]

**(iv)** Calculate the gravitational potential energy of this system of three masses.

gravitational potential energy = ..... J [2]

[Total: 11]