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

.....

.....

.....[2]

(b) The Earth and the Moon may be considered to be isolated in space with their masses concentrated at their centres.
The orbit of the Moon around the Earth is circular with a radius of 3.84×10^5 km. The period of the orbit is 27.3 days.

Show that

(i) the angular speed of the Moon in its orbit around the Earth is $2.66 \times 10^{-6}\,\text{rad}\,\text{s}^{-1}$,

[1]

(ii) the mass of the Earth is 6.0×10^{24} kg.

[2]

(c) The mass of the Moon is 7.4×10^{22} kg.

For Examiner's Use

(i) Using data from **(b)**, determine the gravitational force between the Earth and the Moon.

force = ... N [2]

(ii) Tidal action on the Earth's surface causes the radius of the orbit of the Moon to increase by 4.0 cm each year.

Use your answer in **(i)** to determine the change, in one year, of the gravitational potential energy of the Moon. Explain your working.

energy change = ... J [3]