Section A

Answer **all** the questions in the spaces provided.

1 **(a)** The Earth may be considered to be a uniform sphere of radius 6.37×10^3 km with its mass of 5.98×10^{24} kg concentrated at its centre. The Earth spins on its axis with a period of 24.0 hours.

(i) A stone of mass 2.50 kg rests on the Earth's surface at the Equator.

1. Calculate, using Newton's law of gravitation, the gravitational force on the stone.

gravitational force = ... N [2]

2. Determine the force required to maintain the stone in its circular path.

force = ... N [2]

(ii) The stone is now hung from a newton-meter.

Use your answers in **(i)** to determine the reading on the meter. Give your answer to three significant figures.

reading = ... N [2]

(b) A satellite is orbiting the Earth. For an astronaut in the satellite, his sensation of weight is caused by the contact force from his surroundings.

The astronaut reports that he is 'weightless', despite being in the Earth's gravitational field.

Suggest what is meant by the astronaut reporting that he is 'weightless'.

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