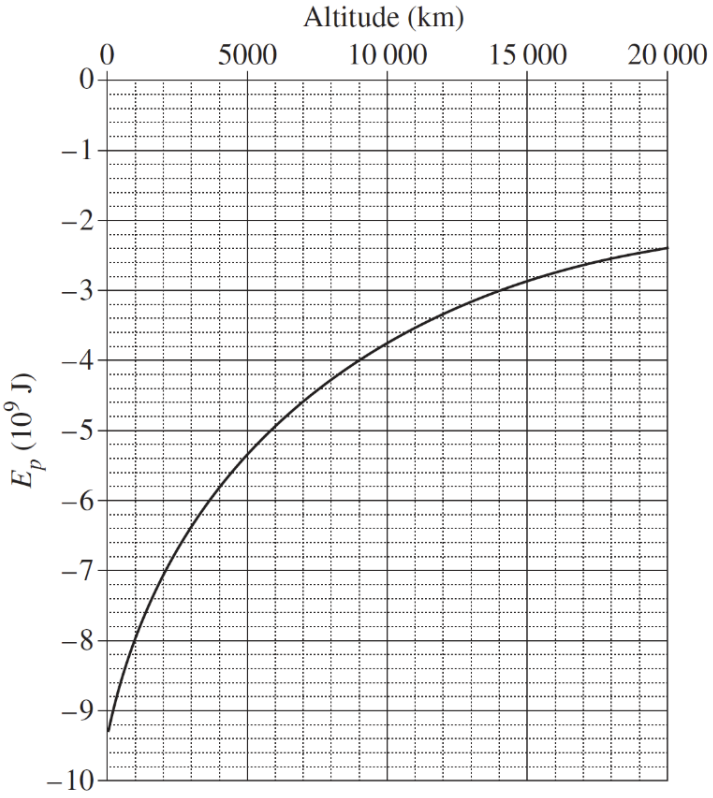
Module 5 Advance Mechanics
HSC Style questions
13 marks

2012

4 The graph shows how the gravitational potential energy (E_p) of a satellite changes with its altitude.



What is the change in gravitational potential energy of the satellite when its altitude is reduced from 14 000 km to 4000 km?

What is the change in gravitational potential energy of the satellite when its altitude is reduced from 14 000 km to 4000 km?

(A) -8.8×10^9 J

(B) -2.8×10^9 J

(C) 2.8×10^9 J

(D) 8.8×10^9 J

9 Compared to a geostationary orbit, which row of the table correctly describes the relative properties of a low Earth orbit?

	Orbital velocity	*Orbital period*
(A)	Higher	Higher
(B)	Higher	Lower
(C)	Lower	Higher
(D)	Lower	Lower

Use the data below to answer Questions 12 and 13.

Orbital period of the Moon around Earth	2.36×10^6 s
Mean orbital radius of the Moon	3.83×10^8 m
Mass of Earth	6.0×10^{24} kg
Mass of the Moon	7.35×10^{22} kg

12 What is the centripetal force experienced by the Moon due to Earth's influence?

(A) 2.0×10^{20} N

(B) 1.6×10^{22} N

(C) 4.7×10^{26} N

(D) 7.6×10^{28} N

13 What is the orbital period of an Earth satellite having an orbital radius half that of the Moon?

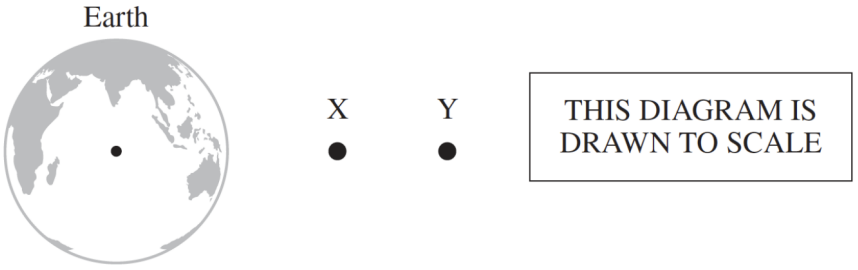
(A) 5.9×10^5 s

(B) 8.3×10^5 s

(C) 1.2×10^6 s

(D) 7.5×10^6 s

18 The gravitational force, due to Earth, on a mass positioned at X is F_x and on the same mass positioned at Y is F_y. The diagram is drawn to scale.



What is the value of $\frac{F_x}{F_y}$?

(A) 1.5

(B) 2.0

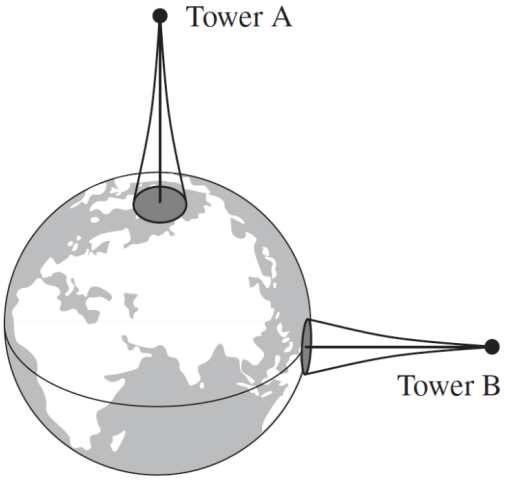
(C) 2.25

(D) 4.0

Question 23 (4 marks)

Consider the following thought experiment. **4**

Two towers are built on Earth's surface. The height of each of the towers is equal to the altitude of a satellite in geostationary orbit about Earth. Tower A is built at Earth's North Pole and Tower B is built at the equator.

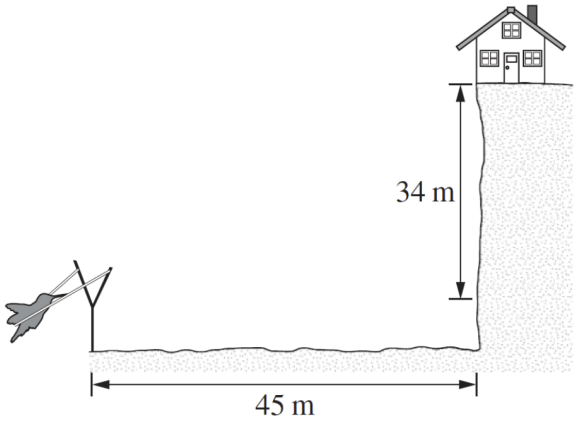


NOT TO SCALE

Identical masses are simultaneously released from rest from the top of each tower. Explain the motion of each of the masses after their release.

Question 27 (4 marks)

A toy bird is launched at 60° to the horizontal, from a point 45 m away from the base of a cliff. **4**



NOT TO SCALE

Calculate the magnitude of the required launch velocity such that the toy bird strikes the base of the wooden building at the top of the cliff, 34 m above the launch height.