

Physics Lesson 1

Projectile Motion

A helicopter is travelling horizontally at a velocity of 110 m s^{-1} and a height of 75.0 m above point Q on the horizontal ground when it releases a package.

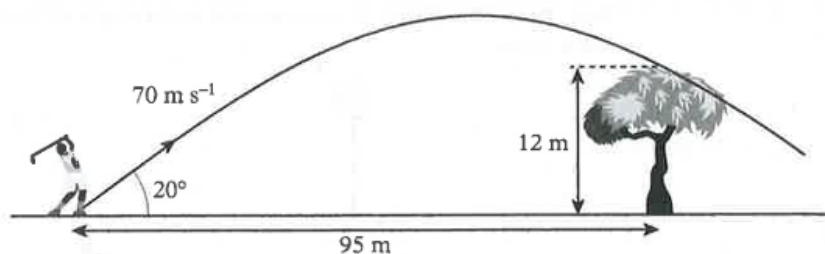


- a) Determine how long it will take the package to reach the ground. Express your answer to 2 decimal places. [1 mark]

- b) Calculate how far from Q the package will land. Express your answer to the nearest whole number.

QUESTION 21 (5 marks)

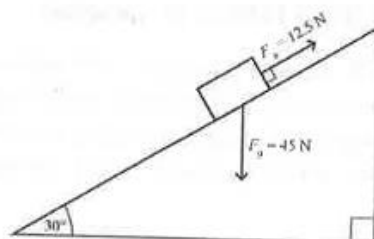
A golf ball is hit at a speed of 70 m s^{-1} and an angle of 20° in the direction of a 12.0 m high tree, which is 95.0 m from the golfer. Predict whether the ball will pass over the tree or hit it. Show your reasoning.



Incline Planes

QUESTION 7 (6 marks)

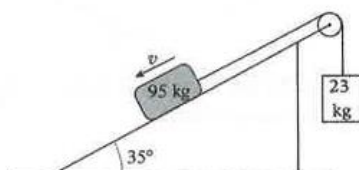
The diagram below shows an object, initially at rest, on a frictionless inclined plane.



Calculate the time it will take for the object to slide 10 m along the slope. Show your working.

QUESTION 9 (5 marks)

A 35° incline supports a 95 kg box that is tied to a lightweight rope that passes over a frictionless pulley at the top of the incline. A 23 kg mass hangs freely from the rope, as shown in the diagram. When allowed to move, the box moves down the incline with an acceleration of 2.50 m s^{-2} .



Calculate the frictional force acting between the box and the incline. Show your working and express your answer to 1 decimal place.

QUESTION 8 (5 marks)

A 33 kg box is placed at rest at the top end of incline that is 4.5 m long and is at an angle of 25° to the horizontal. The box is allowed to slide down the incline and a frictional force of 62 N acts on the box.

- Calculate the magnitude of the acceleration of the box. Express your answer to 1 decimal place. [4 marks]
- Calculate how many seconds it takes for the box to travel from the top of the incline to the bottom. Express your answer to 1 decimal place. 1

Circular Motion

QUESTION 9 (3 marks)

A 5 kg object is experiencing a centripetal force of 80 N and is moving in uniform circular motion with a speed of 8 m s^{-1} .

Calculate the radius of the circular path. Show your working.

QUESTION 4

A ball of mass of 2 kg is attached to a string 150 cm long and is whirled in a horizontal circle. The maximum tension the string can withstand is 15 N. Determine the maximum velocity of revolution that can be given to the ball without breaking the string.

Gravity

QUESTION 7 (2 marks)

Calculate the magnitude and direction of the gravitational field strength at a point 10 km above Earth's surface (mean radius of Earth $r_E = 6.37 \times 10^6 \text{ m}$). Express your answer to 2 decimal places.

QUESTION 4

A planet has radius and mass both double of those of Earth. The value of g on that planet will be

Orbits

QUESTION 10 (3 marks)

The average orbital distance of Mars is 1.52 times the average orbital distance of Earth. Knowing that Earth orbits the Sun in approximately 365 days, use one of Kepler's laws to predict the time for Mars to orbit the Sun.

QUESTION 9 (3 marks)

Newton's laws of motion and the law of gravity can be used to find the mass of a planet by using a relationship between period (T) and average distance (r) of one of its moons from the centre of the planet, and the mass (M) of the planet. Determine the theoretical mass of Neptune, M , using the period of its moon Triton: $T = 5.87$ days, and $r = 377\,750$ km.

Electrostatics

QUESTION 11 (2 marks)

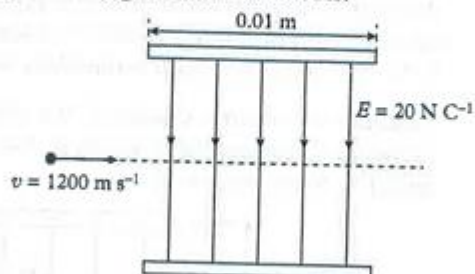
Calculate the value of the electric charge on object A if there is a force between it and object B ($+6.5 \times 10^{-6}$ C) of 0.28 N. The charges are separated by 0.80 m in air.

QUESTION 15 (2 marks)

Determine the strength of an electric field if a charge of $15\,\mu\text{C}$ experiences a force of 750 N when placed in the field.

QUESTION 18 (5 marks)

A positively charged particle of mass 9.60×10^{-26} kg enters a uniform electric field of strength $20.0\,\text{N C}^{-1}$ at right angles with an initial speed of $1200\,\text{m s}^{-1}$, as shown in the diagram below. The charge on the particle is 8.0×10^{-19} C. Ignore any gravitational effects.



- a) Calculate the magnitude and direction of the force on the charged particle. Express the solution using scientific notation to 1 decimal place. [1 mark]

b) Calculate its acceleration

c) Calculate its time of travel

d) Calculate final displacement

