Unit 18 · Dynamics

WORKSHEET

Full marks 24

Name _____ Class _____ Roll no. _____ Date _____ Marks _____ / 24

1 Key words [3]

Fill in the blanks with words from the box. Two words in the box are not needed. Each blank carries 0.5 mark.

equilibrium	**horizontal**	**impulse**	**moment**	**momentum**	**parabola**	**projectile**	**range**

Newton's second law says force equals the rate of change of _____. A force acting for a time gives an _____, equal to the change in momentum. A body thrown into the air and moving under gravity alone is a _____; its path is a _____. The horizontal distance it covers before landing on the level is its _____, and at the highest point of its path its velocity is _____.

2 True or false [3]

Write ✓ for a true statement and ✗ for a false one. Correct the false ones.

i. A projectile's horizontal velocity stays the same throughout its flight. ☐

ii. At the highest point of its path, a projectile's velocity is zero. ☐

iii. Projected at the same speed, at 30° and at 60°, a body has the same range on the level. ☐

iv. The greatest height is reached at 45°. ☐

v. Over a smooth pulley, the tension is the same on both sides of a light string. ☐

vi. In Atwood's machine (two masses over a pulley), the tension equals the heavier weight. ☐

3 Multiple choice [5]

Choose the correct option for each of the following questions. Take $g = 9.8\ \text{m/s}^2$ and ignore air resistance, here and in the rest of the sheet.

i. The unit of impulse is the same as the unit of: [1]

a. force **b.** momentum

c. energy **d.** power

ii. Masses of 5 kg and 3 kg hang over a smooth pulley. Their acceleration is: [1]

a. $9.8\ \text{m/s}^2$ **b.** $3.92\ \text{m/s}^2$

c. $2.45\ \text{m/s}^2$ **d.** $1.96\ \text{m/s}^2$

iii. A body is projected at speed u at angle θ. At the top of its path its speed is: [1]

a. 0 **b.** $u\cos\theta$

c. $u\sin\theta$ **d.** u

iv. The greatest range on the level of a ball thrown at 14 m/s is: [1]

a. 10 m **b.** 20 m

c. 40 m **d.** 14 m

v. Two stones are thrown at the same speed, at 30° and at 60°. The ratio of their times of flight, 30° to 60°, is: [1]

a. 1 : 1, since the ranges are equal **b.** 1 : 2

c. $1 : \sqrt{3}$ **d.** $\sqrt{3} : 1$

4 Short answers [10]

Write short answers to the following questions.

a. A cricket ball of mass 160 g comes to a bat at 25 m/s and is hit straight back at 35 m/s. The bat touches it for 0.02 s. Find the impulse on the ball and the average force of the bat. [2]

b. A ball is kicked at 20 m/s at 30° to the level ground. Find its time of flight, greatest height and range. [3]

c. A block of mass 3 kg on a smooth table is tied by a light string, over a smooth pulley at the table's edge, to a mass of 2 kg hanging freely. They start from rest. Find the acceleration, the tension in the string, and the speed and distance moved after 1.5 s. [5]

Answer:

5 Think [3]

Sadikshya throws a ball at 20 m/s at 30°, and Lakpa throws another at 20 m/s at 60°. Both land the same distance away. Lakpa says, “So our balls spent the same time in the air and went equally high.” Find the time and the greatest height for each, and explain.

6 Activity: The angle of the longest throw (not marked)

You need: a garden hose with a steady flow (or a water bottle with a hole), a protractor and a measuring tape. Hold the nozzle at ground level and point it at different angles; measure where the water lands.

Angle	15°	30°	45°	60°	75°
Range (m)					

Which angle gives the longest range? Which pairs of angles give about the same range? Use the greatest range to work out the water’s speed.