Unit 17 · Statics

WORKSHEET

Full marks 23

Name _____ Class _____ Roll no. _____ Date _____ Marks _____ / 23

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	friction	Lami's theorem	moment	reaction	sine	tension	triangle

A body is in _____ when the forces on it add to zero. Three forces at a point are in equilibrium when, drawn head to tail, they close a _____. By _____, each force is proportional to the _____ of the angle between the other two. The pull in a string is its _____, and a smooth surface pushes on a body with a _____ at right angles to the surface.

2 True or false [3]

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

i. Forces of 3 N, 4 N and 5 N at a point can be in equilibrium. ☐

ii. Forces of 2 N, 3 N and 6 N at a point can be in equilibrium. ☐

iii. In Lami's theorem, the angle that goes with a force is an angle next to it. ☐

iv. A weight hung by two equal strings at equal angles to the vertical pulls equally on both. ☐

v. Two like parallel forces have a resultant equal to their difference. ☐

vi. The reaction of a smooth inclined plane is at right angles to the plane. ☐

3 Multiple choice [5]

Choose the correct option for each of the following questions.

i. In Lami's theorem, $\frac{P}{\sin\alpha} = \frac{Q}{\sin\beta} = \frac{R}{\sin\gamma}$, the angle α is: [1]

a. the angle between P and Q **b.** the angle between Q and R

c. the angle between P and R **d.** the angle of P with the horizontal

ii. Forces of 3 N, 4 N and 5 N at a point are in equilibrium. The angle between the 3 N and 4 N forces is: [1]

a. 37° **b.** 53°

c. 90° **d.** 180°

iii. A weight of 100 N hangs from two equal strings, each at 60° to the vertical. The tension in each string is: [1]

a. 50 N **b.** 57.7 N

c. 100 N **d.** 200 N

iv. Two like parallel forces of 30 N and 10 N are 2 m apart. Their resultant acts: **[1]**

a. 1 m from each
b. 0.5 m from the 30 N force
c. 0.5 m from the 10 N force
d. outside the two forces

v. A body on a smooth plane inclined at θ is held by a horizontal force P. As θ increases towards 90°, P: **[1]**

a. stays equal to the weight
b. decreases to 0
c. grows without limit
d. reaches the weight and stays there

4 Short answers **[9]**

Write short answers to the following questions.

a. A body of weight 50 N rests on a smooth plane inclined at 30°, held by a horizontal force P. Find P and the reaction of the plane. **[2]**

b. Find two like parallel forces 3 m apart that are equivalent to a single force of 60 N, one of them acting 1 m from the given force. **[2]**

c. A lantern of weight 80 N hangs from two strings making 30° and 45° with the vertical, on either side. Find the tension in each string, and check that their horizontal parts balance. **[5]**

Answer:

5 Think [3]

A wet towel of weight 10 N hangs from the middle of a 4 m washing line. Find the tension in the line when it sags 50 cm, and when it sags only 5 cm. Why can't the line ever be pulled perfectly straight?

6 Activity: Weighing with two strings (not marked)

You need: a full 1-liter water bottle (about 10 N with the bottle), two strings, a protractor, and a luggage or spring scale. Tie the bottle to the middle of the strings and hold their ends apart, at different angles.

Angle of string 1 to the vertical	Angle of string 2	T_1 by Lami (N)	T_1 on the scale (N)

How close are the worked-out and measured tensions? What happens as you pull the strings apart?