

## Mechanics 5 – Inclined Planes

Please **complete** this homework by \_\_\_\_\_. Start it early. If you can't do a question you will then have time to ask your teacher for help or go to a drop in session.

### Section 1 – Review of previous topics. Please complete all questions.

1. A particle travels in a straight line with uniform acceleration. The particle passes through three points A, B and C lying in that order on the line, at times  $t = 0$ ,  $t = 2$  s and  $t = 5$  s respectively. If  $BC = 30$  cm and the speed of the particle when at B is  $7$  m/s find the acceleration of the particle and its speed when at A.

2.

x	frequency
0-0.4	18
0.5-0.7	
0.8-1.0	
1.1-1.4	15
1.5-1.8	12

A set of continuous data is recorded to one decimal place.

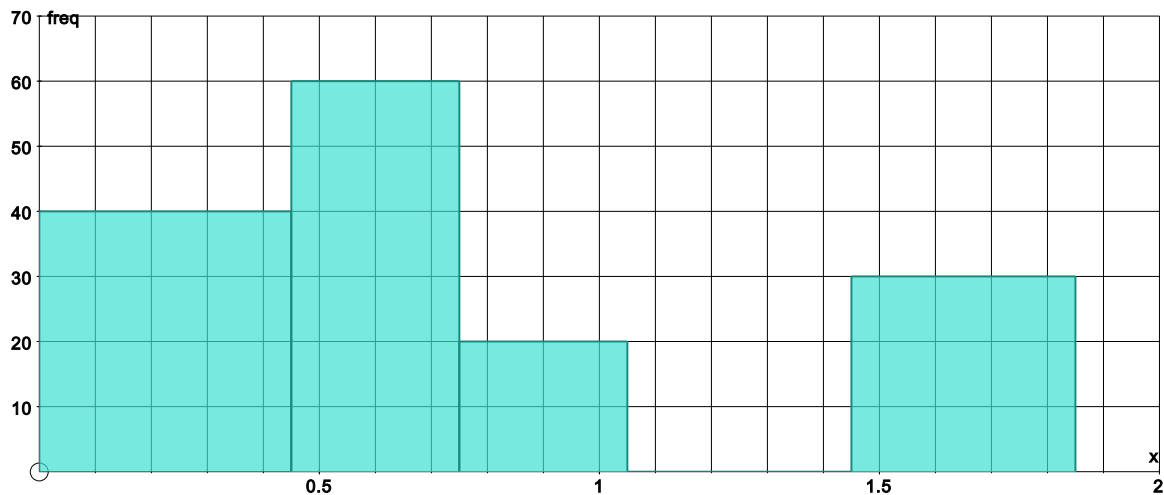
The results are summarised in a histogram.

a) Find the missing frequencies in the table.

b) Calculate the width and height of the missing bar.

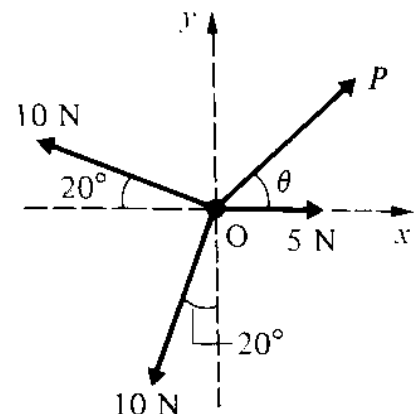
c) Estimate the percentage of values that are

i) below  $0.6$ , ii) above  $1.2$ .



3. Find the constant force needed to accelerate a car of mass  $600$  kg from rest to  $25$  m/s in  $12$  s if the resistance to motion is  $350$  N.

4. By resolving forces horizontally and vertically find the values of  $P$  and  $\theta$



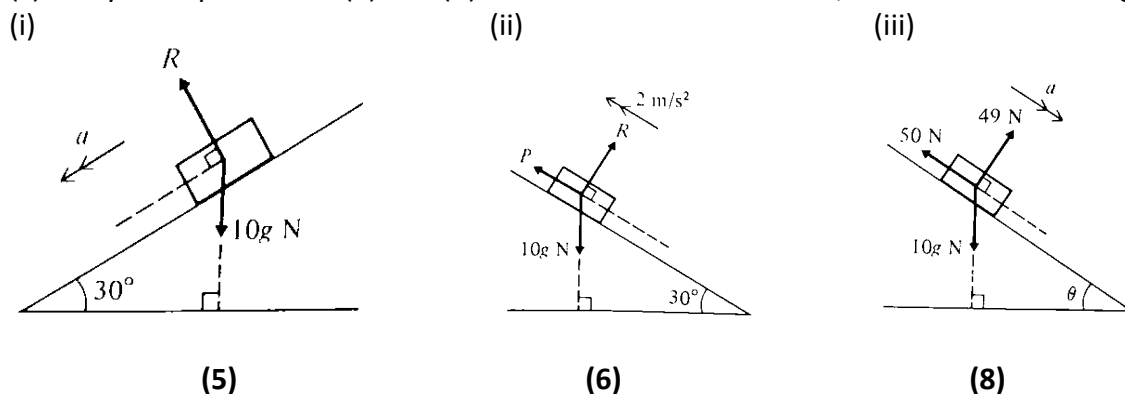
## Section 2 – Consolidation of this week’s topic. Please complete all questions.

1. A force of 5N is pulling a particle of mass 8kg down a smooth plane that is inclined at  $30^\circ$  to the horizontal. Given that the force acts parallel to the plane,
- Draw a force diagram to represent all the forces acting on the particle. (2)
  - Work out the normal reaction between the particle and the plane. (2)
  - Find the acceleration of the particle. (3)

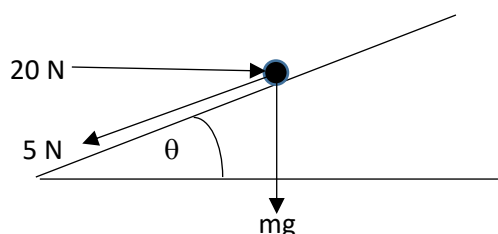
2. A particle of mass 5kg slides down a rough slope that is inclined at  $60^\circ$  to the horizontal. The force of friction is a constant 30N.
- Draw a force diagram to represent all the forces acting on the particle. (2)
  - Work out the normal reaction between the particle and the plane. (2)
  - Find the acceleration of the particle. (3)

3. A body of mass 20 kg is released from rest at the top of a rough slope which is inclined at  $30^\circ$  to the horizontal. Six seconds later the body has a velocity of 21 m/s down the slope. Find the resistance to motion experienced by the body. (Assume this resistance to be constant throughout). (5)

4. Each of the diagrams below shows a body of mass 10 kg accelerating on an inclined plane in the direction indicated. All of the forces acting are as shown. In each case
- Obtain an equation by resolving perpendicular to the direction of motion,
  - Obtain an equation by applying  $F = ma$  parallel to the direction of motion,
  - Use your equations to (a) and (b) to find the unknown forces, accelerations and angles.



5. A particle of mass  $m$  kg is pushed up a rough slope by a horizontal force of 20 N. The particle experiences a constant frictional force of 5 N. Given that  $\tan \theta = \frac{3}{4}$  and that the acceleration of the particle is  $0.4 \text{ m/s}^2$ , show that  $m = 1.75\text{kg}$ . (2dp)



(12)