

O Level Physics

Tutorial 3: Dynamics

Syllabus :

(a) identify and distinguish between contact forces (e.g. friction, air resistance, tension and normal force) and non-contact forces (e.g. gravitational, electrostatic and magnetic forces)

(b) state that mass is a measure of the amount of matter in a body

1. State the definition of mass.

(c) state that a gravitational field is a region in which a mass experiences a force due to gravitational attraction

2. State the definition of gravitational field.

(d) define gravitational field strength, g , as *gravitational force per unit mass placed at that point*

3. (i) State the definition of gravitational field strength, g .

(ii) A packet of rice on a table has a mass of 5 kg. The gravitational force on the rice is 50 N. Using these numbers, calculate the gravitational field strength at the rice.

(e) recall and apply the relationship $weight = mass \times gravitational\ field\ strength$ to new situations or to solve related problems

4. (i) A stone has a mass of 0.5 kg. Find its weight.

(ii) The gravitational field strength on the moon is $1.6\ m\ s^{-2}$. Find the weight of the stone if it is on the moon.

(f) distinguish between mass and weight

5. What is the difference between mass and weight of an object?

How would these be different on the moon, compared to on Earth?

(g) apply Newton's Laws to: (i) describe the effect of balanced and unbalanced forces on a body (ii) describe the ways in which a force may change the motion of a body (iii) identify action-reaction pairs acting on two interacting bodies (stating of Newton's Laws is not required)

6. (a) I push a book slowly at the same velocity on a rough table. Why does the book not go faster and faster?

(b) A smooth disc is sliding along a smooth table. How can I make it go faster, or slower, or change direction?

(c) A piano sits on a big trolley. Suppose there is zero friction between trolley and the flat ground. So when I push it, I should not feel any resistance from friction at all. Why do I still feel tired after pushing it for some time?

(h) identify forces acting on a body and draw free body diagram(s) representing the forces acting on the body (for cases involving forces acting in at most two dimensions)

7. A ball hangs from a string on attached to the ceiling. I push the ball sideways for a short distance and hold it there. Draw a free body diagram representing the forces acting on the ball.

(i) solve problems for a static point mass under the action of three forces for two-dimensional cases by a graphical method

8. In question 7 above, the mass of the ball is 0.1 kg. I push the ball until the string is at 30° to the vertical. Using the free body diagram, find :

- (i) the force I used to push the ball, and
- (ii) the tension in the string.

(j) recall and apply the relationship resultant *force* = *mass* $\times$ *acceleration* to new situations or to solve related problems

(k) show an understanding that mass is the property that resists change in motion of the body (inertia)

9. (i) A box of mass 0.1 kg is pulled with a force of 2 N on a frictionless table. Find the acceleration of the mass.

(ii) Another box with twice the mass is pulled with the same force. Show that the acceleration is halved.

(iii) Why is it that if the above two masses are dropped from the same height at the same time, the bigger mass does not fall faster?

(l) explain the effects of friction on the motion of a body

10. A small disc of mass 0.1 kg is given a starting velocity of 1 m/s on the floor. It stops after 1 s. Find the friction on the disc.

(m) describe the motion of bodies with constant mass falling in uniform gravitational field with or without air resistance, including reference to terminal velocity.

11. (a) What is the acceleration if we drop a stone to the ground?

(b) Describe the acceleration if we drop a feather to the ground.