

USING EQUATIONS TEST 1 with ANSWERS

Some of these answers require you to remember Level 2 Physics and/or common sense.  
(Take  $g = 9.8 \text{ ms}^{-2}$ ,  $h = 6.63 \times 10^{-34} \text{ Js}$ ,  $c = 3 \times 10^8 \text{ m s}^{-1}$ ,  $\epsilon_0 = 8.85 \times 10^{-12} \text{ N}^{-1}\text{m}^{-2}\text{C}^2$ ,  $\epsilon_r = 1$  for air).

1. A mass A of 6 kg moving with a velocity of  $5 \text{ ms}^{-1}$  collides with a mass B of 8 kg moving in the opposite direction at  $3 \text{ ms}^{-1}$ . Calculate the final velocity if the masses stick together on impact.  
 **$0.42 \text{ ms}^{-1}$**
2. An object of mass 2.0 kg starts from rest and slides down a frictionless incline at an angle of  $30^\circ$  to the horizontal. If it slides 2.5 m down the plane, what will be its velocity?  
 **$4.9 \text{ ms}^{-1}$**
3. A wheel has a radius of 0.3 m. It rotates with an angular velocity of  $12 \text{ s}^{-1}$ . What is the linear velocity of a point on the rim of the wheel?  
 **$3.6 \text{ ms}^{-1}$**
4. Calculate the capacitance of a pair of parallel plates of area  $0.025 \text{ m}^2$  if they are separated by a piece of perspex 0.1 mm thick. Take the relative permittivity of perspex to be 3.5.  
 **$7.7 \times 10^{-9} \text{ F}$**
5. What is the resistance of a 240 V, 100 W light bulb?  
**576 ohms**
6. A 5 kg mass extends a spring by 0.50 m. What is the spring constant of the spring?  
 **$98 \text{ N m}^{-1}$**
7. How far apart are two parallel plates in air, area  $0.50 \text{ m}^2$  and capacitance  $1.5 \text{ }\mu\text{F}$ ?  
 **$2.95 \times 10^{-6} \text{ m}$**
8. A yo-yo, initially at rest, is allowed to fall. The yo-yo drops with constant linear acceleration. After 1.40 seconds it has fallen 1.20 m and reached an angular velocity of 4090 revolutions per minute. What angle (in radians) does the yo-yo turn through during the fall of 1.20 m?  
**47.7 radians**
9. How much torque is needed to bring a flywheel with moment of inertia  $0.2 \text{ kg m}^2$  rotating at  $50 \text{ rad s}^{-1}$  to rest in 20 seconds?  
**0.5 N m**
10. The time taken for a neutron to travel 6 m in a straight line is 0.3 ms. If a neutron has a mass of  $5 \times 10^{-26} \text{ kg}$ , calculate its kinetic energy.  
 **$1 \times 10^{-17} \text{ J}$**
11. Calculate the wavelength of sound being emitted at a frequency of 10 Hz from a stationary source. The speed of sound in air is  $330 \text{ ms}^{-1}$ .  
**33 m**
12. Calculate the gravitational force between a 5.0 tonne lead sphere and 2.0 tonne sphere which are 75 cm apart (take  $G = 6.67 \times 10^{-11} \text{ Nm}^2\text{kg}^{-2}$ ).  
 **$1.19 \times 10^{-3} \text{ N}$**