Tutorial Sheet (dynamics, work)
Note g = 9.81ms^{-2}

1/ What are the SI units for
a) force
b) energy
c) work
d) power
e) momentum

2/ What force is needed to produce an acceleration of 5 ms^{-2} for an object of mass 6 kg ?
[30 N]

3/ If a force of 12 N acts on a body of mass 2.4 kg calculate the resulting acceleration.
[5 m/s]

4/ A block of mass 8 kg is placed on a level surface. What is the magnitude and direction of the reaction force exerted by the surface on the block ?
[78.5 N, upwards]

5/ A block of mass 6 kg is sent sliding across a horizontal surface and is observed to decelerate at a rate of 9.2 ms^{-2} because of the presence of friction. Calculate the decelerating force on the block and the coefficient of kinetic friction between the block and the surface. If a 10 kg mass was attached to the top of the block and the experiment repeated would the observed deceleration be greater than, less than, or equal to 9.2 ms^{-2}?
[55.2 N, 0.94]

6/ What force is required to produce an acceleration of 5 ms^{-2} for an object of mass 5 kg ? It is observed in a real situation that when this force is applied to a mass of 5 kg the acceleration produced is only 3 ms^{-2} due to friction. Calculate the frictional force and the coefficient of friction.
[25 N, 10 N, 0.2]

7/ A bullet of mass 0.1 kg travelling at 2 x 10^{2} ms^{-1} collides with a stationary wooden block of mass 5 kg. The bullet imbeds itself in the block. Calculate the momentum of the bullet before the collision. Use conservation of momentum to calculate the velocity of the block and bullet after the collision.
[20 kgms^{-1}, 3.92 ms^{-1}]

8/ An object of mass 4 kg moving with a velocity of 10 ms^{-1} in the +X direction collides with an object of mass 1 kg moving in the -X direction with a velocity of 4 ms^{-1}. After the collision the two masses stick together. Calculate their common velocity after the collision.
[7.2 ms^{-1} in +X]

9/ A horizontal force of 5 N is required to maintain a velocity of $2ms^{-1}$ for an object sliding over a rough surface. How much work is done by the force in 50s?

[500J]

10/ An object of mass 2 kg is initially at rest. If a force of 10 N is applied for a period of 10 s calculate the acceleration during the 10 s interval, the final velocity of the object, and the final kinetic energy of the object. Also calculate the distance travelled and the work done by the force.

[5 ms^{-2}, 50 ms^{-1}, 2.5 x 10^3 J, 250 m, 2.5 x 10^3 J]

11/ A body of mass 5 kg is dropped from the top of a building 100 m high. Calculate it's potential energy when dropped, it's kinetic and potential energy 70 m from the ground, it's velocity and potential energy 40 m from the ground and it's velocity and potential energy just before impact.

[4905 J, 1472 J, 3434 J, 34.3 ms^{-1}, 1962 J, 44.3 $ms^{-1,}$, 4905 J]

12/ An object of mass of 3.5 kg and velocity 8 ms^{-1}collides with a stationary object of mass 10.5 kg. The two objects stick together after the collision. Use conservation of momentum to work out the amount of energy lost during the collision.

[84 J]