**Dynamics Worksheet 4 – Work, Energy & Power**

1. A car is travelling at 27 m/s north and has a mass of 1500 kg. Calculate the kinetic energy of the car. (5.47 x 105 J)
2. A 1.1 kg brick is lifted from the ground to a height of 3.5 m. Determine the change in potential energy of the brick. Use the acceleration due to gravity as 9.8 ms-2. (37.7 J)
3. Determinethe kinetic energyofa 300 kg space probe launched from the surface of Mars, once it has reached escape velocity of 5.1 km/s. (3.90 x 109 J)
4. An army tank of 2.5 x 104 kg mass has a kinetic energy of 1.25 x 106 J. Calculate the speed of the tank. (10ms-1)
5. An electric radiator supplies 7.56 x 106 J of energy in a time of 1.0 hour. Determine the power of the radiator. (2.1 x 103 W)
6. A large truck travelling east collides and coalesces with a car travelling west. Both vehicles are traveling at 25 ms-1. Describe the energy transformations that may occur during such a collision. (See below question 9 for a sample answer.)
7. A girl throws a 0.06 kg ball vertically upwards with a kinetic energy of 18.75 J. The ball leaves her hand at a height of 1.20 m above the ground. Assume the acceleration due to gravity is 9.8 ms-2. Determine:
   1. The total height reached by the ball above the ground. (33.1 m)
   2. The gain in potential energy experienced by the ball from its launch position to the top of its trajectory. (18.75 J)
8. Determine the amount of work that must be done by the engine of a 500 kg racing car to change the velocity of the car from 55 ms-1 east to 60 ms-1 east. If this change in velocity was accomplished in 0.3 s, calculate the acceleration of the car. Find the net force applied by the engine to cause this acceleration. (143750 J, 16.67 ms-2, 8335 N)
9. A car accelerates uniformly from rest to a speed of 23.0 ms-1. If the net force applied by the engine is 5,060 N, determine the power supplied by the engine. (5.82 x 104 W.)

**Sample answer to question 6:** The kinetic energy of the truck and the car will most probably be transformed into several different forms of energy. Heat (friction), sound and light (sparks) will be produced. Metal and other materials will be deformed (twisted, stretched & compacted). Energy can be stored by such processes – usually referred to as elastic energy – it is a form of potential energy. Some translational kinetic energy (the KE of an object moving along a straight-line path) will be transformed into vibrational KE as the two vehicles collide. If either vehicle rolls then translational KE will be transformed into rotational KE. If the fuel carried by either vehicle explodes, the chemical potential energy stored in the fuel will be transformed into heat, light, sound and kinetic energy (if it blows parts of the vehicles apart).