**EXAMPLES 2 TO 5 – Solving Physics Problems**

**Example 2:**

**A train travels from one station, A, to the next station, B, at a constant speed of 100 km/h and returns at a constant speed of 150 km/h.  Compare the average speed and the average velocity for this journey.**

**Warning: The average speed is NOT 125 km/h.  Why not?  The reason is that the acceleration is not constant over the whole journey.  This is not one continuous trip where a train accelerates uniformly from 100 km/h to 150 km/h and we want to calculate its average speed over that period of time.  The train in this question must accelerate and decelerate albeit briefly on each leg of its journey.**

**Example 3:**

**A stone is thrown vertically upwards with a velocity of 29.4 m/s from the edge of a cliff 78.4 m high.  The stone falls so that it just misses the edge of the cliff and falls to the ground at the foot of the cliff.  Determine the time taken by the stone to reach the ground.  Assume the acceleration due to gravity is 9.8 ms-2.**

**Example 4:**

**A police car is parked at the side of a highway with its engine running.  A car speeds past the police car at 30m/s.  The police immediately give chase, moving with a constant acceleration until they catch the speeding car after 50 s.  The speeding car maintains a constant speed of 30 m/s throughout the chase.**

1. **Sketch the motion of both the speeding car and the police car on a velocity-time graph.**
2. **Calculate the speed of the police car at the instant it reaches the speeding car.**
3. **Use the graph to determine the acceleration of the police car.**

**Example 5:**

**Two cars have a collision at a 90o intersection.  Car A of mass 500 kg was travelling west at 20 ms-1 before the collision.  Car B of mass 650 kg was travelling north at 25 ms-1 before the collision.  After the collision the cars were locked together.  Find:**

**(a)   the momentum of car A before the collision;**

**(b)   the momentum of car B before the collision;**

**(c)   the total momentum before the collision;**

**(d)   the total momentum after the collision;**

**(e)   the loss in kinetic energy during the collision.**