Questions: Past year semester papers

1. A bus is driven from Town *M* to Town *N*, 60km away, at an average speed of 90km/h. The bus is at Town *N* for 10 minutes and is then driven back to Town *M*.

Find the average speed for the journey from Town *N* to Town *M* if the average speed for the complete journey is 90km/h. 120 km/h [4]

What is the average velocity of the car for the complete journey? 0 km/h [2]

2. Find the distance travelled in 5 minutes by a car moving with a constant speed of 60km/h. 5km [3]

Find the time taken by the car to travel 200m at the same speed. 12s [2]

3. A particle passes through three points A, B and C in succession, where AB = 10m, BC = 70m, with constant acceleration. The velocity of the particle at B is double that of the particle at A and the time taken to travel from B to C is 10s. Calculate,

(a) the velocity at A $2ms^{-1}$ [2]

(b) the acceleration of the particle $0.6\ ms^{-2}$ [1]

(c) the velocity at C. $10ms^{-1}$ [2]

4. A car moving at 30 ms^{-1} begins to retard uniformly at junction A with a retardation 0.5 ms^{-2}, to a speed of 5 ms^{-1} at another junction B. The car then moves from B to C a distance 150 m. at a speed of 5 ms^{-1} and then accelerates uniformly at 0.4 ms^{-2} to reach D at 40 ms^{-1}.

Sketch the velocity-time graph for the journey from A to D. [2]

Find (i) the time taken for the journey from A to B, B to C and C to D 50, 30, 87.5 [3]

(ii) the distance A to D 3000 [2]

5. (a)Two particle A and B are moving in the same direction on a wide horizontal track. At time t = 0, the particle A, travelling with a speed of 30 ms^{-1} retarding uniformly at 4 ms^{-2}, overtakes B, which is travelling at 18 ms^{-1} and accelerating uniformly at 2 ms^{-2}. Calculate

(i) The time that elapse before the velocities of A and B are equal. 2s [3]

(ii) The velocity of A and B when B overtakes A. 14, 26 [4]

(b) A car moves along a straight line ABC. It starts from rest at A and moves with constant acceleration 2 ms^{-2} until it reaches B. It then moves from B to C with an acceleration of 1 ms^{-2}. The time in seconds taken to travel from A to B is equal to the time taken from B to C and is denoted by T. Show that 5AB = 2BC. [6]

6. Three points *A*, *B*, *C* on a motor racing track are such that *B* is 1 km beyond *A* and *C* is 2 km beyond *B*. A car *X*, moving with uniform acceleration takes 1 minute to travel from *A* to *B* and $1\frac{1}{2}$ minutes to travel from *B* to *C*. Find its acceleration in km/h^2 and show that its speed at *C* is 92km/h. 960 km/h, 2 [6]

7. A racing car emerging from a bend reaches a straight stretch of road. The start of the straight stretch is the point O and there are two marker points, A and B, further down the road. The distance $OA = 64$ m and the distance $OB = 250$ m. The car passes O at time 0 s and, moving with constant acceleration, passes A and B at times 2 s and 5 s respectively. Find

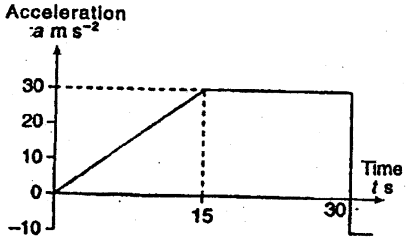
(a) the acceleration of the car, $12 ms^{-2}$

(b) the speed of the car at B. $80 ms^{-1}$

8. A small ball is released from rest and falls on to a horizontal platform which is descending vertically with a constant speed of 7 m s^{-1}. Given that the ball is 12 m above the platform at the instant of release, calculate the time that elapses before the ball hits the platform.
[Take $g = 10$ m s^{-2}.]

2·4s

9. A rocket is fired vertically upwards. Ignition and liftoff occur at time $t = 0$. Burnout occurs after 30 seconds and the rocket then continues moving vertically as a projectile. The acceleration of the rocket is recorded by on-board accelerometers which give the following trace:



From the trace determine expressions for the acceleration for each of the two periods $0 \le t \le 15$ and $15 < t \le 30$. From the first of these expressions find an expression in terms of t for the speed v of the rocket during the first 15 seconds of flight, assuming that v is initially zero. Hence find the rocket's speed when $t = 15$. From the second expression for acceleration find an expression for the additional speed gained during the period $15 < t \le 30$. Hence find the speed of the rocket at burnout.