Test – Linear Motion – Kinematics /1

A Physics

1. (a) Explain the difference between speed and velocity (2)

(b) How can an object have constant speed but changing velocity? (1)

2. Write the 4 Equations of Motion (4)

Explain all symbols + give all units (5) (9)

- Take $g = 10\ m/s^2$ (is positive)
- Air Resistance = 0
- Remember axes + scales of graphs

3. A runner starts from rest, accelerates at $5\ m/s^2$ for 2 sec. to a steady speed, and maintains this to the end of the race. He runs the race in a time of 21.0 sec.

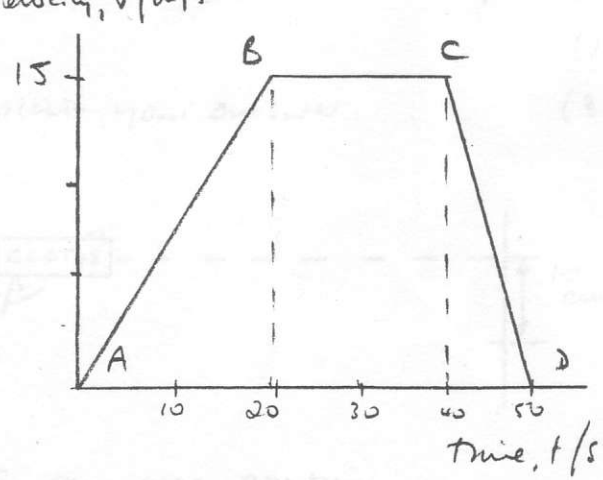
(a) Sketch a graph of velocity against time (5)

(b) What distance is the race? (3)

Sketch graphs of (c) acceleration vs. time (3)

(d) distance vs. time (3) 14

4. The graph shows a car's motion on a level road.



(a) Describe qualitatively (no numbers!) the motion in each stage, AB, BC and CD. (3)

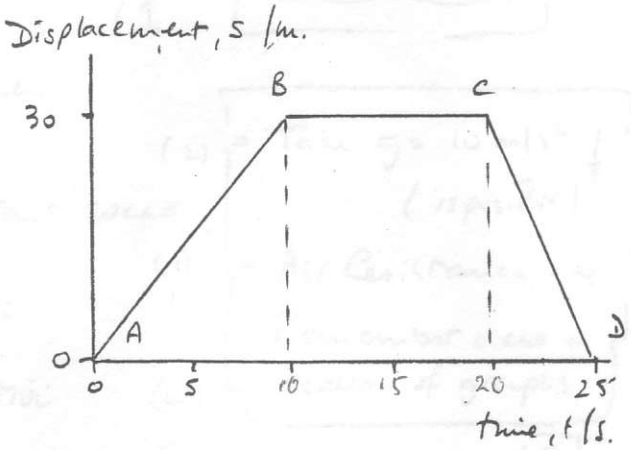
(b) What is the acceleration in CD? (3)

(c) What is the total distance travelled? (3)

(d) At C the driver sees a car stopped 80 m ahead, and immediately puts on the brakes. Will the car stop in time? Explain. (2)

(e) What is the speed 1 sec. before stopping? (1) 12

5. The displacement/time graph describes the motion of an object. Describe fully (ie with numbers) the motion of the object in...



(a) AB

(b) BC

(c) CD. $3 \times 3 =$ [9]

6. In his latest film "Die Hard 3½" the hero, Bruce Willis, has to jump a river 90 m wide in his car, as shown →

(a) What is the vertical component of his initial velocity? (2)

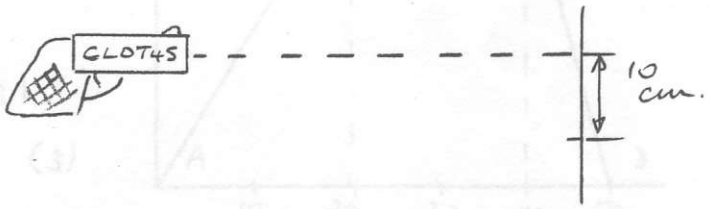
(b) What is the horizontal component? (2)

(c) What maximum height does he reach above his start point? (2)

(d) What is his time of flight? (2)

(e) Does he reach the other side? Explain your answer. (3)

7. A man points a gun horizontally and fires at a target 20 m away. He finds that the bullet hits the target below the spot at which the gun was pointing.



(a) Explain why this happens. (2)

(b) Calculate the speed of the bullet leaving the gun (4)

(c) Calculate the velocity of the bullet when it hits the target (4) [10]

8. Sketch graphs for velocity/time, and acceleration/time for a ball bouncing twice on a hard floor. [6]

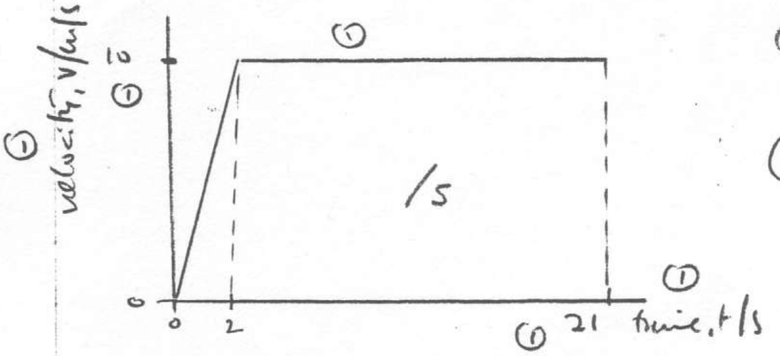
Test – Linear Motion – Answers! A Physics

1 (a) Speed – magnitude / size only velocity – size + direction

(b) – it's to do with changing direction! [3]

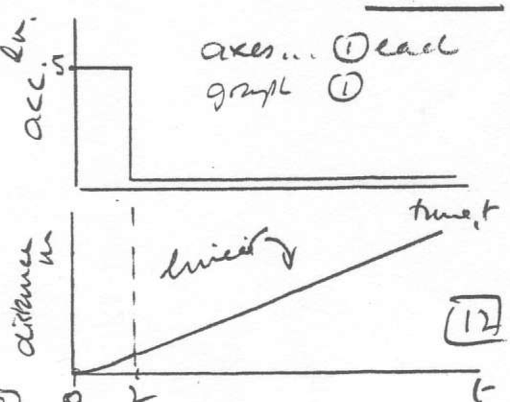
2. – See your notes!! - - - - - - - - - - [9]

3.



(b) distance = area under graph
$= (\frac{1}{2} \times 10 \times 2) + (19 \times 10) = 200$ m

(c + d)



[12]

4. AB – const. accel. BC – constant V CD – constant accel^n

(b) CD – $a = \Delta v / t = -15/10 = -1.5$ m/s^2 ③

(c) Distance = area under graph $= (\frac{1}{2} \times 10 \times 15) + (20 \times 15) + (\frac{1}{2} \times 10 \times 15) = 525$ m (3)

(d) Distance in CD = area = 75 m Yes the car stops in time (2)

(e) 1 s. before stopped v = 0 – accel^n = 1.5 m/s (1) [12]

5. (a) AB – constant velocity (not speed) 3 m/s ① BC – stationary v = 0 m/s ① CD – constant velocity returning to start v = –6 m/s ① [9]

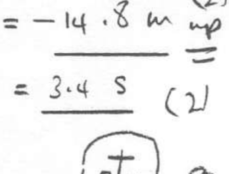
6. (a) $u_V \uparrow = 30 \sin 35 = 17.2$ m/s (2)

(b) $u_H \rightarrow = 30 \cos 35 = 24.6$ m/s (2)

(c) height max. $v^2 = u^2 + 2as$ so $s_{max} = -u^2/2a = -14.8$ m up (2)

(d) t_{flight} $s \uparrow = ut + \frac{1}{2}at^2 = t(u + \frac{1}{2}at) \rightarrow t = 0$ or $t = \frac{-2u}{a} = 3.4$ s (2)
s = 0 at start (t = 0) and end (t = t_{flight})

(e) Range $d = u_H t_{flight} = 84$ m No – he does not (3)



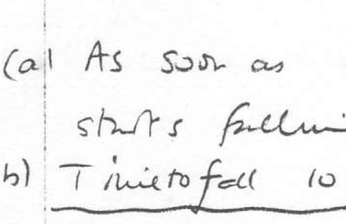
[11]

7. (a) As soon as bullet comes out of the muzzle it starts falling, with vertical acceleration = g = 10 m/s^2 (2)

(b) Time to fall 10 cm ↓. $s \downarrow = ut + \frac{1}{2}at^2 = \frac{1}{2}at^2 \rightarrow t = 0.14$ s
Bullet must get to target in 0.14 s so $V_H = d/t = 141$ m/s

[8]

(c)



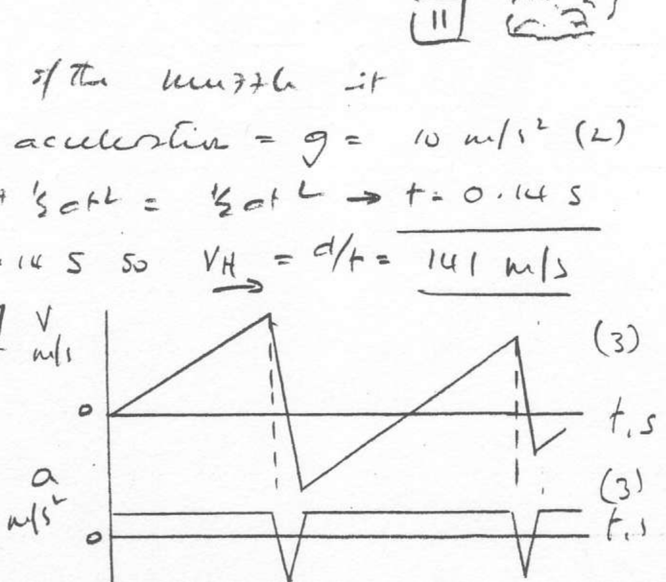
$V_V = u + at = 1.4$ m/s

$V = \sqrt{V_V^2 + V_H^2} = 141$ m/s
$\tan \theta = 1.4/141 \rightarrow \theta = 0.6°$

TZH 2.98 phew!

[10]

Total / 72



(3)

(3)