**COMET BAY COLLEGE**

**Physics - Unit 2 - Task 3**

**Motion Test 1**

**Name: Total Marks /57**

Note: Show working for all mathematical answers.

**Question 1** :

In 1894 a species of Peregrine Falcon was discovered in Indonesia by Richard B. Sharpe. The falcon was recorded taking only 0.514 seconds to move between two emergence trees which were 180 m apart.

a) What is the average speed in m s-1? **(2 marks)**

v = = (1 mark)

v = 350.2 m s-1  (1 mark)

b) What is the speed in km h-1? **(2 marks)**

v = 350.2 × (1 mark)

v = 1260.72 km h-1  (1 mark)

**Question 2** **:**

Thomas the turtle at Perth zoo travels 0.3m in 10.8 seconds on average. What is the average speed of this reptile in ms-1? **(2 marks)**

v = = (1 mark)

v = 0.0278 ms-1 (1 mark)

**Question 3:**

A car is travelling Southwest at a speed of 40 ms-1 when a man throws a can out of the right window at a speed of 8 ms-1 at right angles to the car. What is the resultant of the can relative to the ground? **(4 marks)**

45

R2 = 402 + 82 (1 mark)

R = 40.8 ms-1 (1 mark)

Ø = tan-1 () = 11o (1 mark)

Angle is 11o + 45o = 56o

R = 40.8 ms-1 S56oW (1 mark)

Ø

R

40

8

**Question 4** **:**

Below is a graph showing the displacement over time of a moving car. NOTE: between t = 0 and t = 10 the displacement is parabolic.

Displacement (m)

Tangent of Line AB at Point B

**E**

**D**

**B**

**C**

**A**

Time (s)

Tangent of Line AB at Point B

2

1

0

-1

-2

S1: vi= 0 (1)

vf = = 2.5 (1)

S2: v = 0 (1)

S3: v = = -2(1)

S4: v = = 2 (1)

S1

S2

S3

S4

On the two blank graphs below, draw up the corresponding ;

a) velocity versus time graph (show working on side), and

b) acceleration versus time graph (show working on side).

0.2

0.1

0

-0.1

-0.2

S1: a = = 0.25 (1)

S2: a = 0 (1)

S3: a = 0 (1)

S4: a = 0 (1)

S1

S2

S3

S4

**Question 5:**

Harry was riding his bike when a tree branch fell from a tree onto the bike path 8 m in front of the bike. It took Harry 0.18 s before he applied the brakes that slowed his bike from 8.2 ms-1 to zero with a deceleration of 4.25 ms-2. Did Harry stop in time or hit the branch?

Two displacements to consider

s1: u = 8.2 ms-1 and t = 0.18 s

v = , hence s1 = v × t = 8.2 × 0.18 = 0.656 m (2 marks)

s2: u = 8.2 ms-1, v = 0 (1 mark) and a = 4.25 ms-1

v2 = u2 + 2as

0 = 8.22 + 2 × -4.25 × s (1 mark)

s = 7.91 m (1 mark)

sT = s1 + s2

sT = 0.656 + 7.91 (1 mark)

sT = 8.57 m (1 mark)

Harry hit the branch with 0.57 m left before stopping. (1 mark)

**Question 6:**

Jenny is dropping her kids off to child care. She pulls out of her drive way with an acceleration of 0.3 m s-2, which she maintains for 1.5 minutes. She then remains at this constant speed for 8 minutes, before taking 20 seconds to slow to a stop in front of the child care. Calculate

a) Jenny’s maximum velocity. (3 marks)

Forward as positive

a = +0.3 ms-2 v = u + at

u = 0 (1 mark) v = 0 + 0.3 × 90 (1 mark)

t = 1.5 × 60 = 90 s v = 27 ms-1 (1 mark)

v = ?

(1 mark)

b) Her deceleration in the last 20 seconds. (4 marks)

Forward as positive

u = 27 ms-1 v = u + at

v = 0 ms-1 (1 mark) 0 = 27 + a × 20 (1 mark)

t = 20 s a = -1.35 ms-2 (1 mark)

a = ? decelerates at 1.35 ms-2 (1 mark)

(1 mark)

c) The distance to the child care centre. (8 marks)

**At time 0 to 90 sec**

a = 0.3 ms-2 s = ?

t = 90 s s = ut + ½at2 v2 = u2 +2as

u = 0 s = 0 + ½ × 0.3 × 902 (1 mark) 272 = 02 + 2 x 0.3 x 5

v = 27 ms-1 s = 1215 m(1 mark) s = 1215 m

**At time 90 to 570 sec**

v = 27 ms-1 s = vt

t = 8 × 60 = 480 s s = 27 × 480 (1 mark)

s = 12960 m(1 mark)

**At time 570 to 590 sec**

a = -1.35 ms-2 s = ?

t = 20 s s = ut + ½at2

u = 27 ms-1  (1 mark) s = 27 × 20 + ½ × -1.35 × 202 (1 mark)

v = 0 ms-1 s = 270 m(1 mark)

**Total distance =** 1215 + 12960 + 270 = 14445 m = 1.44 × 104 m (1 mark)

d) Her average speed over the entire journey. (2 marks)

s = 1.44 × 104 mv = =

t = 590 s (1 mark) v = 24.4 ms-1 (1 mark)

(1 mark)

**Question 7:**

A rocket moves straight upward, starting from rest with an acceleration of 24.9 ms-2. It runs out of fuel after 4.0 s and continues upward to a maximum height before falling back to Earth.

a) Find the rockets velocity at the point it runs out of fuel (t = 4s)? (3 marks)

Up as positive

a = +24.9 ms-2 v = u + at

t = 4 s v = 0 + 24.9 × 4 (1 mark)

u = 0 (1 mark) v = 99.6 ms-1 (1 mark)

v = ?

(1 mark)

b) Find the maximum height the rocket reaches. (7 marks)

Up as positive

**For s2:**

a = -9.8 ms-2 v2 = u2 + 2as or v = u + at and s = ut + ½ at2

s2 u = 99.6 ms-1 (1 mark) 0 = 99.62 + 2 × -9.8 × s2 (1 mark)

v = 0 s2 = 506.13 m (1 mark)

s2 = ?

s1 **For s1:**

a = +24.9 ms-2 s1 = ut + ½ at2

u = 0 (1 mark) s1 = 0 + ½ × 24.9 × 42 (1 mark)

t = 4 s s1 = 199.2 m (1 mark)

s1 = ?

Total height = s1 + s2 = 506.13 + 199.2 = 705.33 m (1 mark)

**Question 8 :**

A biker speeding along at 35 km h-1 slams on his brakes and decelerates to 8 km h-1 in 1.5 s. What was his average acceleration?

u = 35 km h-1 = 9.72 m s-1 (1 mark) v = u + at

v = 8 km h-1 = 2.22 m s-1 2.22 = 9.72 + a × 1.5 (1 mark)

t = 1.5 s a = - 5 m s-2 (1 mark)

a = ? decelerates at 5 m s-2 (1 mark)