Name:_____

Assignment due:

St Patrick's College, Silverstream

PHYSICS

Mechanics Assignment 1

Motion, kinematics

Level 2

90255 Demonstrate understanding of mechanics

You may find the following formulae useful

$$v = \frac{\Delta d}{\Delta t} \qquad a = \frac{\Delta v}{\Delta t} \qquad v_f = v_i + at$$

$$d = v_i t + \frac{1}{2}at^2 \qquad d = \frac{v_i + v_f}{2}t \qquad v_f^2 = v_i^2 + 2ad$$

$$a_c = \frac{v^2}{r}$$

$$F = ma \qquad \tau = Fd \qquad F = -kx$$

$$F_c = \frac{mv^2}{r} \qquad p = mv \qquad \Delta p = F\Delta t$$

$$E_p = \frac{1}{2}kx^2 \qquad E_k = \frac{1}{2}mv^2 \qquad \Delta E_p = mg\Delta h$$

$$W = Fd \qquad P = \frac{W}{t}$$

$$g = 9.8ms^{-2}$$

NZIP 2008

QUESTION ONE: SKATEBOARDING

The diagram shows Rowena is skateboarding in a park. She starts from rest and reaches a uniform velocity of 2.0 ms^{-1} in 8.5 seconds.

(a)   Calculate the distance travelled by Rowena in 8.5 s.

_____

_____

_____

_____

distance = _____

QUESTION ONE: BOATING

Tom and Jill are paddling a canoe across a lake. The **total mass** of Tom, Jill and their boat is 190 kg.

(a) In the photograph they are accelerating from a speed of 0.5 m s^{-1} to a speed of 3.5 m s^{-1} in 9.50 s.

Calculate their **acceleration**.

Write your answer to the correct number of **significant figures**.

_____

_____

_____

_____

_____

(b) Calculate the **distance** Tom and Jill travels while they are accelerating from a speed of 0.5 m s^{-1} to a speed of 3.5 m s^{-1} in 9.50 s.

_____

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_____

NZIP 2006

Tamarah and Aaron went to a cricket match.

QUESTION ONE: THE OPENING BOWLER

(a)   The opening bowler bowled fast. The speed of each bowl was measured and shown on a screen. The speed of the first bowl was measured to be **140** kilometre per hour.

Show that this speed is **39** metres per second.

_____

_____

(b)   The cricket pitch was **20** metres long. Calculate the time for the ball to travel the length of the cricket pitch.

_____

_____

_____ Time = _____ s

(f)   The second bowler also tried to bowl fast but he was bowling into a head wind. The ball left his hand travelling at **36ms^{-1}** but was slowed by the wind at an acceleration of a = **−3.4ms^{-2}**. Calculate the speed of the ball when it reached the batter, **18**m away.

_____

_____

NZIP 2005

QUESTION THREE: KINEMATICS. The 100m sprint

Mary is at the start of her 100m sprint race. She is at rest and, at the firing of the starting gun; she accelerates for 4.0s up to her sprinting speed. She travels 19.2 m while accelerating.

(a)   Calculate Mary's acceleration.

_____

_____

_____ Acceleration = _____

(b)   Calculate the speed Mary attains after these first 4.0 seconds.

_____

_____ Speed = _____

Mary runs the rest of the race at a constant velocity and records a time of 12.8s.

(c)   Calculate this constant velocity.

_____

_____

_____ Velocity = _____

Mary breaks the tape and then slows down from a velocity of 8.8ms^{-1} to a stop in 6.0s.
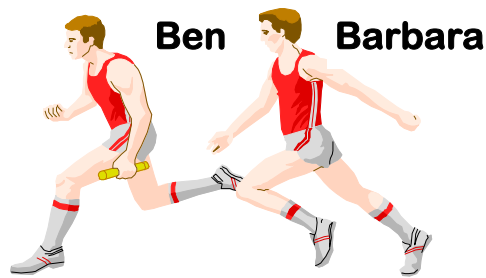
(d)   How far did Mary run while she was slowing down?

_____

_____

_____ Distance = _____

NZIP 2005

QUESTION FOUR: MOTION GRAPHS. Changing the relay baton

Ben   **Barbara**

Barbara and Ben are members of the relay team. The velocity-time graph shown below shows the motion of both runners from the time when Ben starts to run and receives the baton from Barbara, until Barbara slows to a stop at 5.5s. The runners are at the same position on the track at 2.5s.
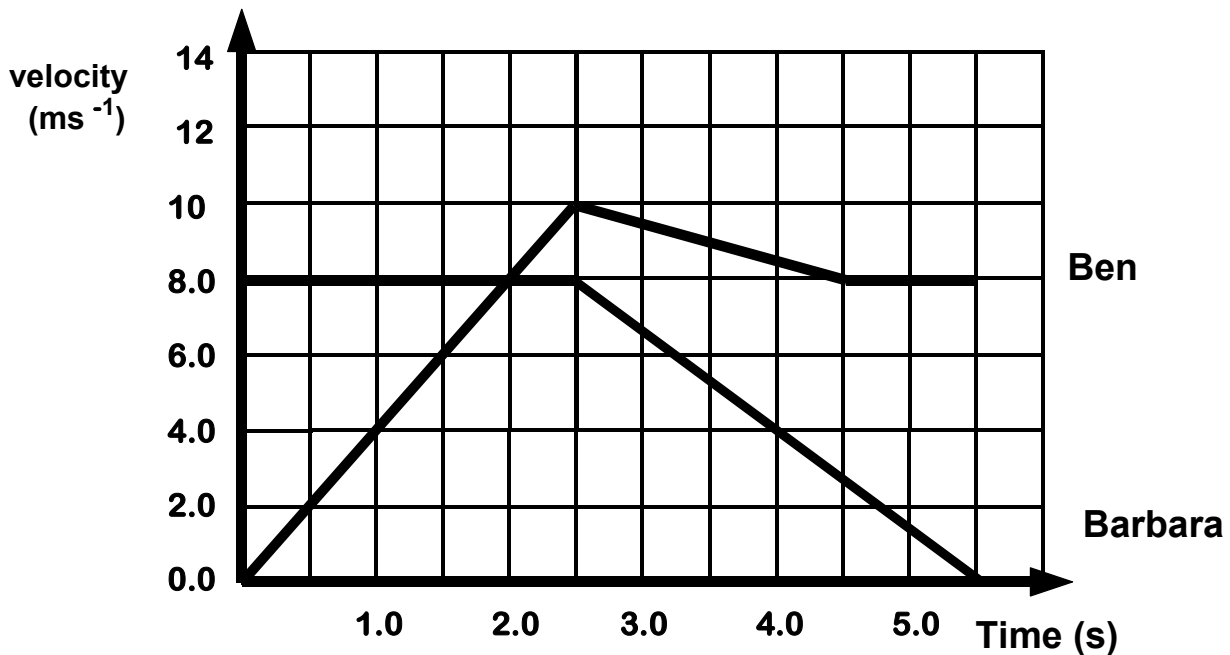
(a)   Calculate Ben's acceleration in the first 2.5s.

_____

_____ Acceleration = _____

(b)   Show that the distance Ben moved in the first 2.5s was 12.5m.

_____

_____

(c)   Determine how far Ben was in front of Barbara when she first started to move.

_____

_____

_____

_____ Distance in front = _____

(d)   Calculate Barbara's average velocity over the complete motion shown.

_____

_____
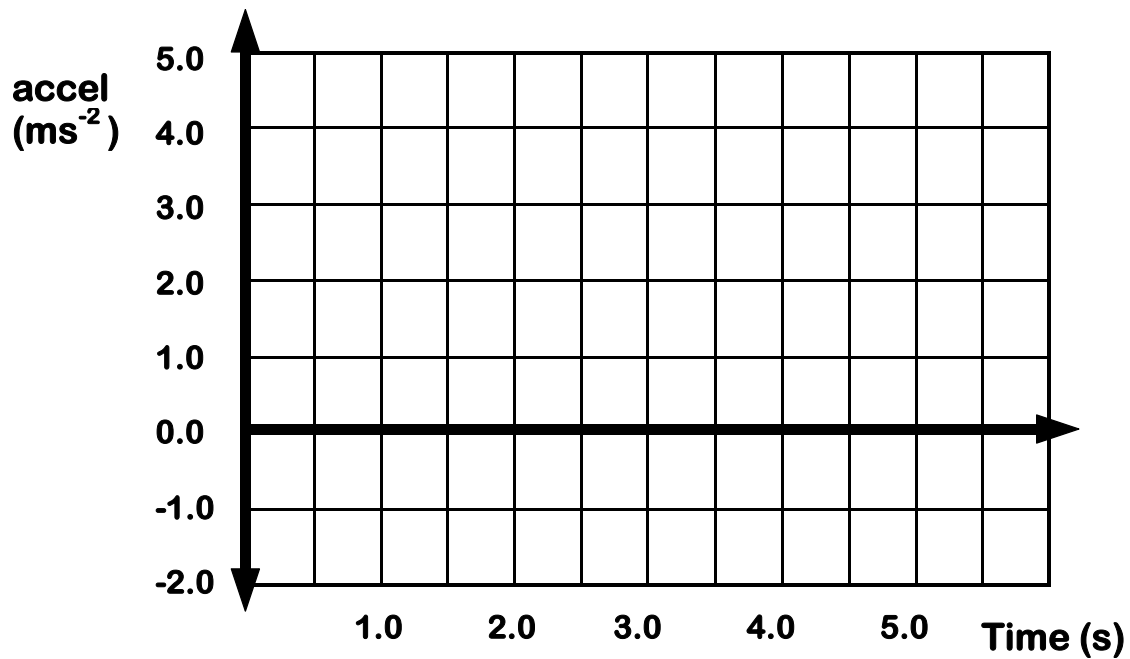
_____ Average velocity = _____

(e)   Draw, on the graph below, the acceleration - time graph of Ben's motion.

NZIP 2009
QUESTION ONE: TAKE OFF

An aircraft starts from rest and accelerates constantly for 52.0 s on a runway before lifting off. The distance travelled during this time is 1200 m.

(a)   Calculate the final speed of the aircraft just before it takes off the runway. Express your answer in km h^{-1}.

_____

_____

_____

_____

final speed = _____

NZIP 2009
QUESTION TWO: LANDING

The aircraft arrives at its destination airport and touches down on the runway at a speed of 48 ms^{-1}. It then decelerates uniformly through a distance of 850 m to reach a final speed of 3.5 ms^{-1}.

(a)   Calculate the deceleration of the aircraft.

_____

_____

_____

_____

deceleration = _____