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Level 1 Science, 2015

90940 Demonstrate understanding of aspects of mechanics

9.30 a.m. Tuesday 10 November 2015
Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of aspects of mechanics.	Demonstrate in-depth understanding of aspects of mechanics.	Demonstrate comprehensive understanding of aspects of mechanics.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should attempt ALL the questions in this booklet.

If you need more room for any answer, use the extra space provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–15 in the correct order and that none of these pages is blank.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

TOTAL

ASSESSOR'S USE ONLY

You may find the following formulae useful.

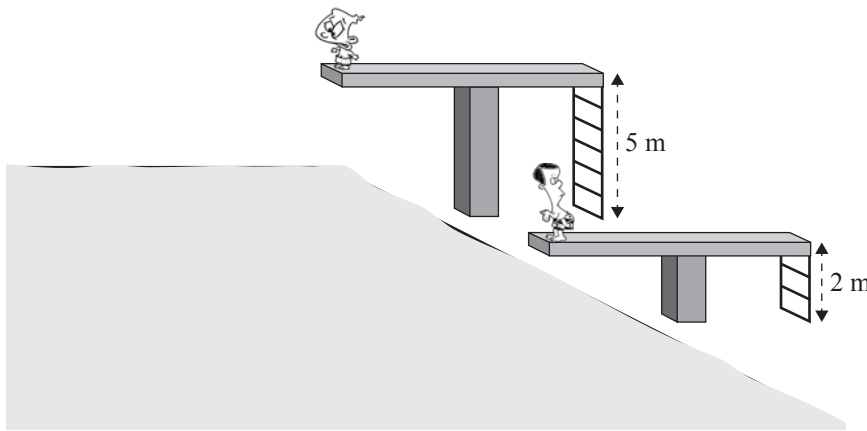
$$v = \frac{\Delta d}{\Delta t} \quad a = \frac{\Delta v}{\Delta t} \quad F_{\text{net}} = ma \quad P = \frac{F}{A} \quad \Delta E_p = mg\Delta h$$

$$E_k = \frac{1}{2}mv^2 \quad W = Fd \quad g = 10 \text{ N kg}^{-1} \quad P = \frac{W}{t}$$

The value of g is given as 10 m s^{-2}

QUESTION ONE: SWIMMING POOL

Chris and Ian were jumping off different platforms into a pool.



- (a) It took Chris 0.60 s to reach the water once he had jumped from the 2 m platform.

Calculate his average speed.

- (b) How much work did Chris (48 kg) do when he climbed up the stairs to the 2 m platform?

(c) Ian's mass is 52 kg.

Why did Ian do more work climbing up the 5 m ladder compared to Chris climbing up the 2 m ladder?

No calculations are needed.

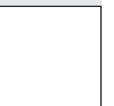
(d) Ian jumps into the pool from the 5 m platform.

Calculate Ian's speed as he is about to hit the water (assuming conservation of energy).

In your answer you should:

- name the types of energy Ian has before he jumps, AND as he is about to hit the water
- calculate Ian's speed as he is about to hit the water.

- (e) Explain why Ian's actual speed as he is about to hit the water, is slower than that calculated in part (d).



QUESTION TWO: FORCES

The kererū (also known as New Zealand wood pigeon or kūkupa) is one of the largest pigeons in the world.

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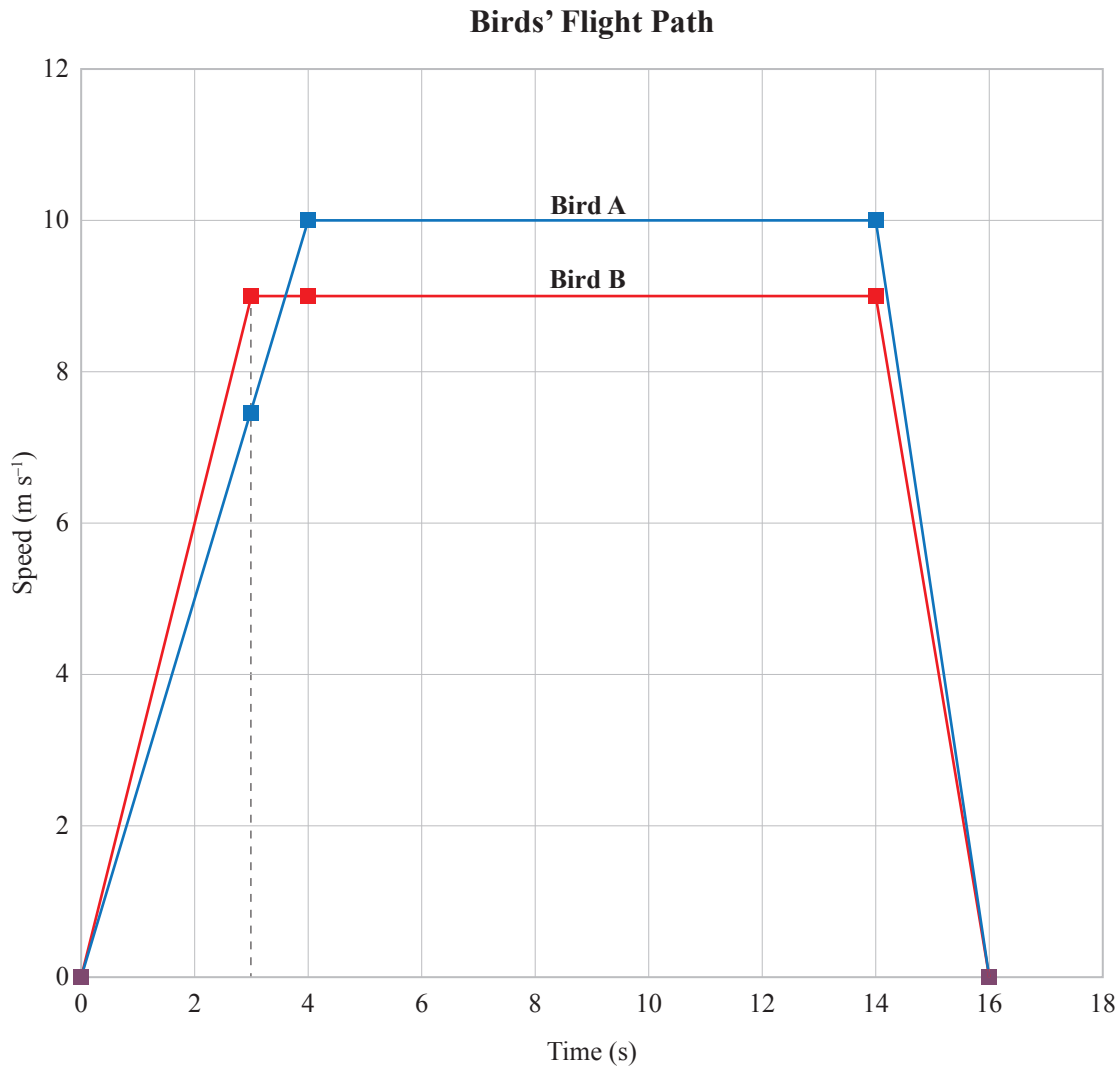
<http://nzbirdsonline.org.nz/species/new-zealand-pigeon>

- (a) (i) Explain the difference between mass and weight.

- (ii) Calculate the weight of a kererū that has a mass of 630 g.

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The examination continues on the following page.**

- (c) The speed-time graph shows the flights of two birds.

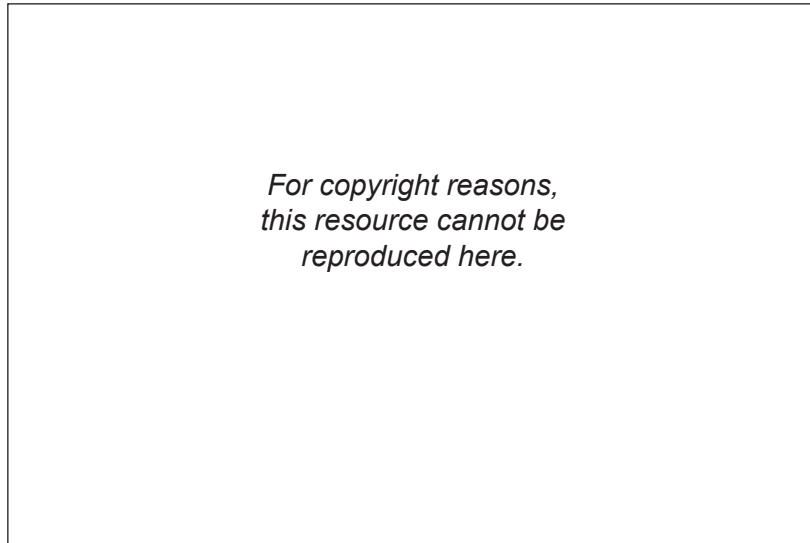


- (i) Use the graph to explain which bird has the greater acceleration in the first 3 seconds.
Calculation is not required but may be used.

(ii) In 16 s, **Bird B** travelled 121.5 m.

How much further did **Bird A** travel in the same time?

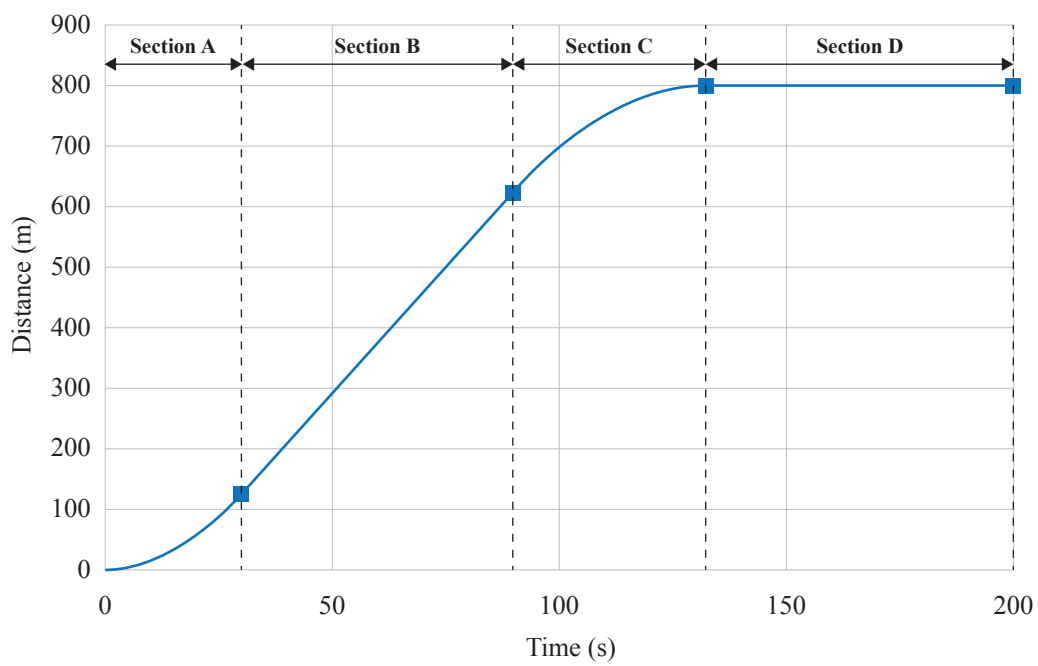
Show all working.

QUESTION THREE: ROWING

<http://www4.pictures.zimbio.com/gi/Zoe+Stevenson+Samsung+World+Cup+Sydney+T5PIDwyWCo8l.jpg>

The distance-time graph below shows the journey of a rowing boat in a race.

Distance-time graph for rowing race



- (a) Describe the motion of the boat throughout the journey.

No calculations required.

Section A: _____

Section B: _____

Section C: _____

Section D: _____

- (b) During the first 30 s of the race, the rowers' speed changed from 0.0 m s^{-1} to 8.3 m s^{-1} . During this time they covered 125 m. The total mass of the rowers and the boat is 140 kg.

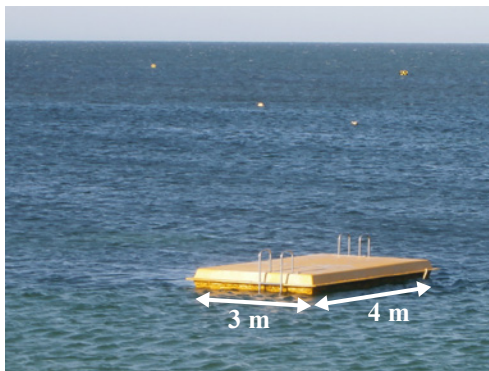
- (i) Calculate the boat's **average acceleration** during the first 30 seconds.

Show your working.

- (ii) Calculate the **work done** to cover the distance of 125 m.

Show your working.

- (c) Two people rowed out to a pontoon floating in the water.

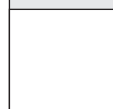


The pontoon has a mass of 185 kg. The dimensions of the pontoon are shown in the photo above.

- (i) Use surface area and force to calculate the pressure exerted by the pontoon on the water.

- (ii) The two people then climb onto the pontoon and stand on it.

Explain why the pontoon will sink lower in the water when the people stand on it.



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