

Newton's Third Law

Question Paper

Level	A Level
Subject	Physics
Exam Board	Edexcel
Topic	Mechanics
Sub Topic	Newton's Third Law
Booklet	Question Paper
Paper Type	Open Response

Time Allowed: minutes

Score: /

Percentage: /100

Grade Boundaries:

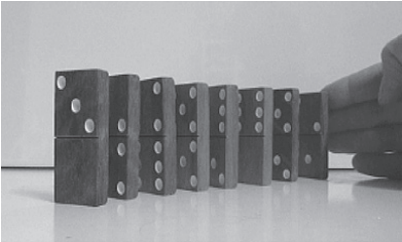
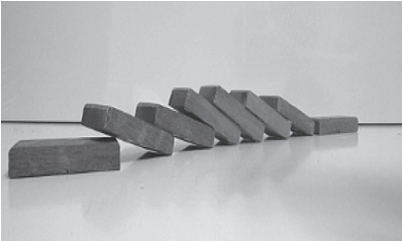
A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 A teacher sets up two experiments for her students to complete.

The outcome of each experiment can be explained using Newton’s laws.


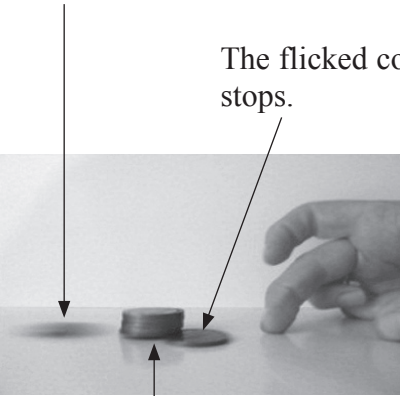
(a) Use Newton’s first law of motion to explain the behaviour of the dominoes in experiment 1.

(2)

Experiment 1	Explanation
<p>Falling dominoes</p> <p>The first domino is given a gentle push.</p>  <p>Observation</p> <p>The domino falls, knocking the next domino; one by one the dominoes fall.</p> 	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>

*(b) Apply Newton's laws of motion to explain the three observations in experiment 2.

(6)

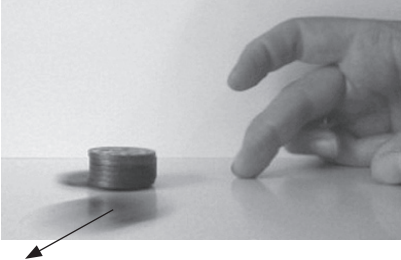
Experiment 2	Explanation
<p>Stacked coins</p> <p>A coin is flicked towards a stack of coins.</p>  <p>Observations</p> <p>The bottom coin is knocked out from under the stack.</p>  <p>The stack drops down.</p>	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>

(c) Whilst carrying out the stacked coins experiment, the student sometimes observed that the flicked coin did not stop but changed its direction of travel.

Suggest a reason for this observation.

(2)

Observation



The coin that was flicked changes its direction.

Reason

Reason
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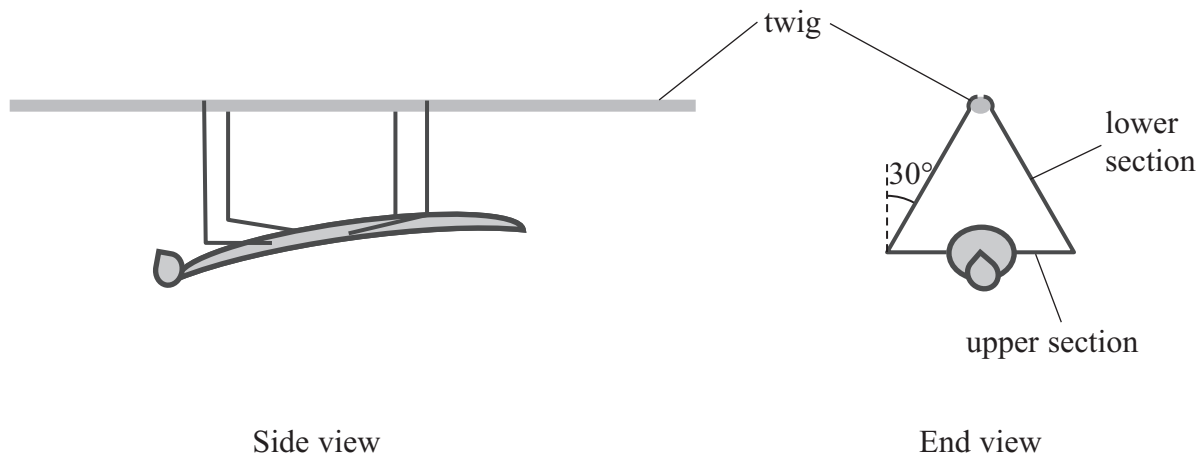
(Total for Question = 10 marks)

- 2 The photograph shows a praying mantis hanging from a thin twig. Four of the praying mantis's six legs are in contact with the twig. The tension in the legs balances the weight to keep the praying mantis stationary.



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- (a) The diagrams show a simplified model of the situation. For each leg in contact with the twig, the upper section is horizontal and the lower section is at an angle of 30° to the vertical.



- (i) Calculate the tension in the lower section of each leg in contact with the twig assuming that these tensions are all equal.

mass of praying mantis = 5.4×10^{-4} kg

(4)

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Tension =

- (ii) A student suggests that the tension in each leg in contact with the twig is 25% of the weight of the praying mantis. State why this is **not** correct.

(1)

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- (b) The praying mantis moves around the twig so that it is now standing upright and on top of the twig.

State the difference between the stress in the legs when the praying mantis is beneath the twig and when it is on top of the twig.

(1)

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(Total for Question = 6 marks)

- (b) When placed at rest on water, piece Y remained in one position whilst spinning around.

Suggest why piece Y remains in one position.

(2)

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(Total for Question = 7 marks)