

91171



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2

SUPERVISOR'S USE ONLY

Level 2 Physics, 2015

91171 Demonstrate understanding of mechanics

9.30 a.m. Tuesday 17 November 2015
Credits: Six

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

Make sure that you have Resource Sheet L2-PHYSR.

In your answers use clear numerical working, words and/or diagrams as required.

Numerical answers should be given with an appropriate SI unit.

If you need more space for any answer, use the page(s) provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–12 in the correct order and that none of these pages is blank.

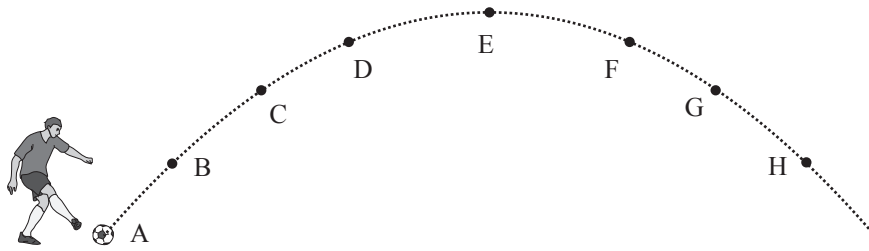
YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

TOTAL

ASSESSOR'S USE ONLY

QUESTION ONE: PROJECTILES

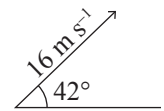
Roy kicks a ball. The diagram below shows the trajectory of the ball. You may assume air resistance to be negligible.



If you need to redraw your labelled arrows, use the spare diagram on page 10.

- (a) On the diagram draw **labelled arrows of appropriate length** to show the following:
- the force on the ball at position C and at position G
 - the horizontal component of the velocity of the ball at position B and at position H
 - the vertical component of the velocity of the ball at position D and at position F.

- (b) The ball is kicked with an initial velocity of 16 m s^{-1} , at an angle of 42° to the ground.



Calculate the initial horizontal and vertical components of the velocity of the ball at position A.

- (c) State the horizontal and vertical components of the velocity of the ball at position E.
Explain your answers.

QUESTION TWO: ICE SKATING

Janet and Roy are ice skating.

- (a) At one point, Roy is standing still, and Janet glides up to him from behind and grabs him by the shoulders. Janet's velocity as she glides up to Roy is 5.0 m s^{-1} , and together they glide off at a velocity of 2.2 m s^{-1} in the same direction as Janet was gliding (assume that both Janet's and Roy's skates are pointing in the direction of travel). Roy has a mass of 65 kg.

- (i) State the law of physics that applies to this situation.

- (ii) Calculate Janet's mass.

- (iii) Explain why you can use the assumptions you made when calculating Janet's mass.

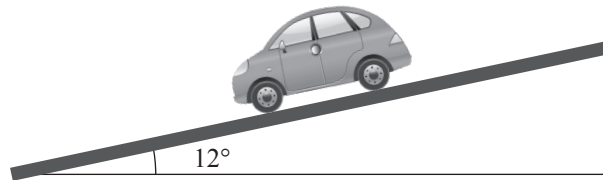
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<http://sport-kid.net/ice-skating-fall-couple.html>

QUESTION THREE: JANET'S CAR AND SPRINGS

Janet arrives home. She parks the car on a slope that is at 12° to the horizontal, as shown in the diagram below.

- (a) Draw **labelled arrows** to show the **individual forces** acting on the car.



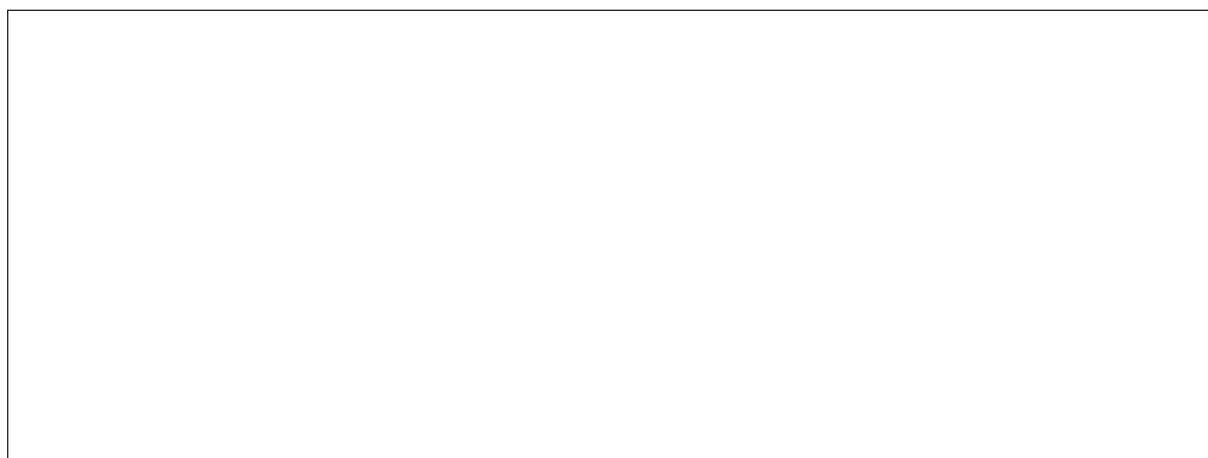
If you need to redraw your labelled arrows, use the spare diagram on page 10.

- (b) Explain in terms of forces acting on the car, how the car remains stationary on the slope.
You may draw a vector diagram to help your explanation.

- (c) The mass of the car is 1500 kg.

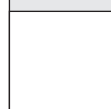
Carry out calculations to show how forces keep the car stationary while it is parked on the slope.

You may draw a vector diagram to help your calculation.



- (d) The sofa in Janet and Roy's house has springs. When Roy sits on the sofa, the springs compress by 0.075 m.

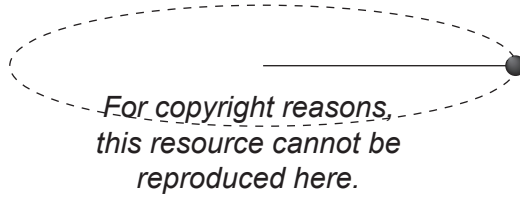
Calculate the elastic potential energy stored in the springs. (Roy has a mass of 65 kg.)



QUESTION FOUR: CIRCULAR MOTION AND TORQUES

- (a) Janet swings a ball tied on a string in a horizontal circle above her head.

Explain why the ball is accelerating even though it is swinging at constant speed.



<http://www.shutterstock.com>

- (b) The length of the string is 0.75 m. It takes 0.84 seconds for the ball to go around her head once.

Calculate the acceleration of the ball.

- (c) Name the force that causes the ball to accelerate as it goes in a circle.

Explain why the force causes the ball to accelerate.

- (d) Janet's study table has two panels, one at each end. Janet has a pile of books on her table.

Use the details given below to calculate the support force provided by panel A of the study table.

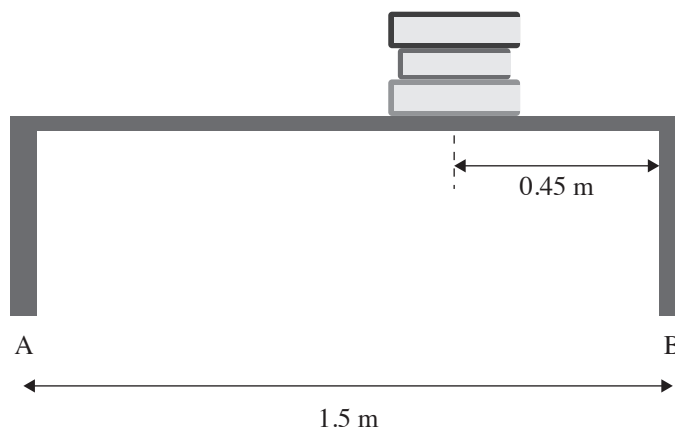
Mass of table = 37 kg

Length of table = 1.5 m

Mass of books = 7.4 kg

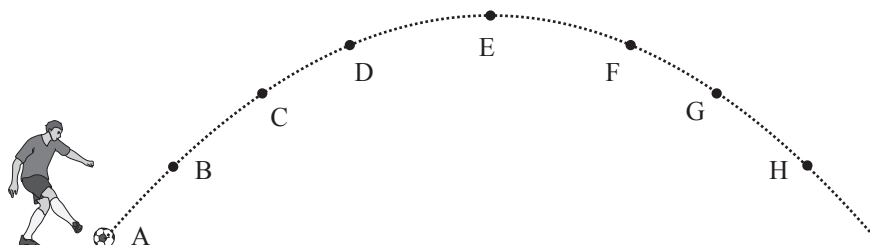
The weight of the books acts at a distance of 0.45 m from end B of the table.

Assume Janet's study table is uniform.



SPARE DIAGRAMSASSESSOR'S
USE ONLY

If you need to redraw your labelled arrows on the diagram from Question One (a), draw them on the diagram below. Make sure it is clear which diagram you want marked.



If you need to redraw your labelled arrows on the diagram from Question Three (a), draw them on the diagram below. Make sure it is clear which diagram you want marked.

