



Centre Number

71

Candidate Number

General Certificate of Secondary Education  
2010–2011

## Science: Double Award (Modular)

Forces and Energy

End of Module Test

# C

Higher Tier

[GDC02]



THURSDAY 11 NOVEMBER 2010, AFTERNOON

### TIME

45 minutes.

### INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

Write your answers in the spaces provided in this question paper. Answer **all twelve** questions.

### INFORMATION FOR CANDIDATES

The total mark for this paper is 50.

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

For Examiner's  
use only

Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	

Total  
Marks



1 Flora lifts a bag of potatoes onto a shelf 200 cm high. The bag weighs 80 N.

Calculate the amount of work Flora does in joules.

**You are advised to show your working out.**

Work = \_\_\_\_\_ J [4]

2 A jeep and a sports car are shown.



© Hemera/Thinkstock



© Hamann Motorsport GmbH

Give two reasons why the sports car is more stable than the jeep.

1. \_\_\_\_\_ [1]

2. \_\_\_\_\_ [1]

Examiner Only	
Marks	Remark
<input type="text"/>	<input type="text"/>
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3 A loudspeaker changes energy from one type to another.



© CVR - Audio

The loudspeaker shown produces 3 J of sound energy for every 75 J of electrical energy input.

(i) Calculate the efficiency of the loudspeaker.

**You are advised to show your working out.**

Efficiency = \_\_\_\_\_ [3]

(ii) Circle the unit, if any, for efficiency from the following list.

joule

newton

no unit

watt

[1]

(iii) Why can the efficiency of the loudspeaker never be greater than 1?

\_\_\_\_\_  
\_\_\_\_\_ [1]

Examiner Only	
Marks	Remark
○	○

4 A cyclist rides around a bend as shown.



© Cycle Logic Racing

(a) What force allows the cycle to go round the bend?

\_\_\_\_\_ [1]

The total mass of cyclist and cycle is 115 kg and he goes around the bend at a constant speed of 6 m/s.

(b) Calculate their total momentum.

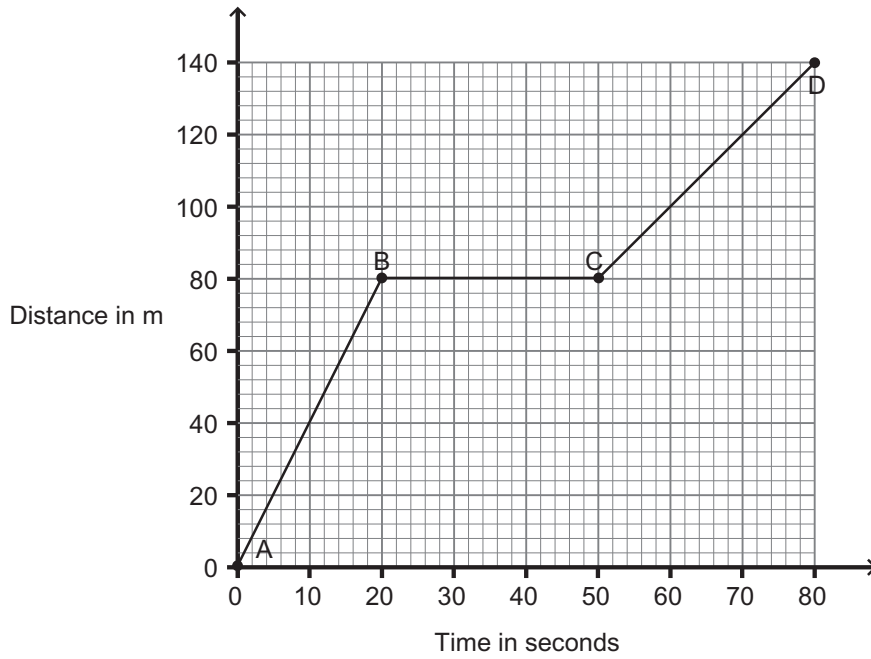
Remember to include the correct unit.

**You are advised to show your working out.**

Momentum = \_\_\_\_\_ [4]

Examiner Only	
Marks	Remark
○	○

5 The distance-time graph for an athlete is shown.



(a) During which region **AB**, **BC**, or **CD** is the athlete running fastest?  
Give a reason for your answer.

Region \_\_\_\_\_ [1]

Reason \_\_\_\_\_

\_\_\_\_\_ [1]

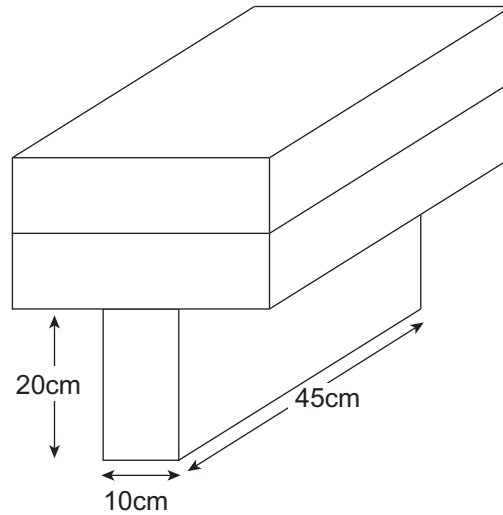
(b) Calculate the athlete's speed during the region **CD**.

**You are advised to show your working out.**

Speed = \_\_\_\_\_ m/s [3]

Examiner Only	
Marks	Remark
○	○

- 6 The diagram shows three stacked building blocks. Each block has a weight of 300 N.



- (a) With the help of the figures on the diagram, calculate the pressure exerted on the ground in  $\text{N}/\text{cm}^2$ .

**You are advised to show your working out.**

Pressure = \_\_\_\_\_  $\text{N}/\text{cm}^2$  [3]

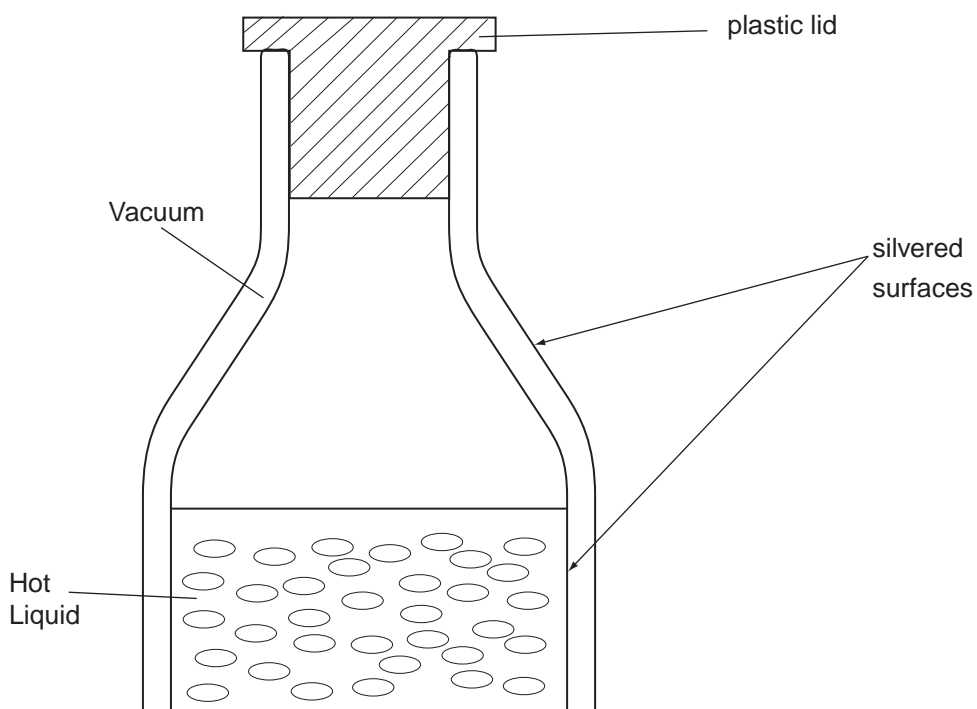
It is possible to change the bottom block so that the pressure exerted is greater than the value you have calculated.

- (b) Suggest how the bottom block should be arranged to give this greater pressure.

\_\_\_\_\_ [1]

Examiner Only	
Marks	Remark
○	○

7 A vacuum flask is constructed to keep liquids hot.



Complete the table below to show which methods of heat transfer are reduced by each of the features labelled in the diagram.

The first row has been done for you.

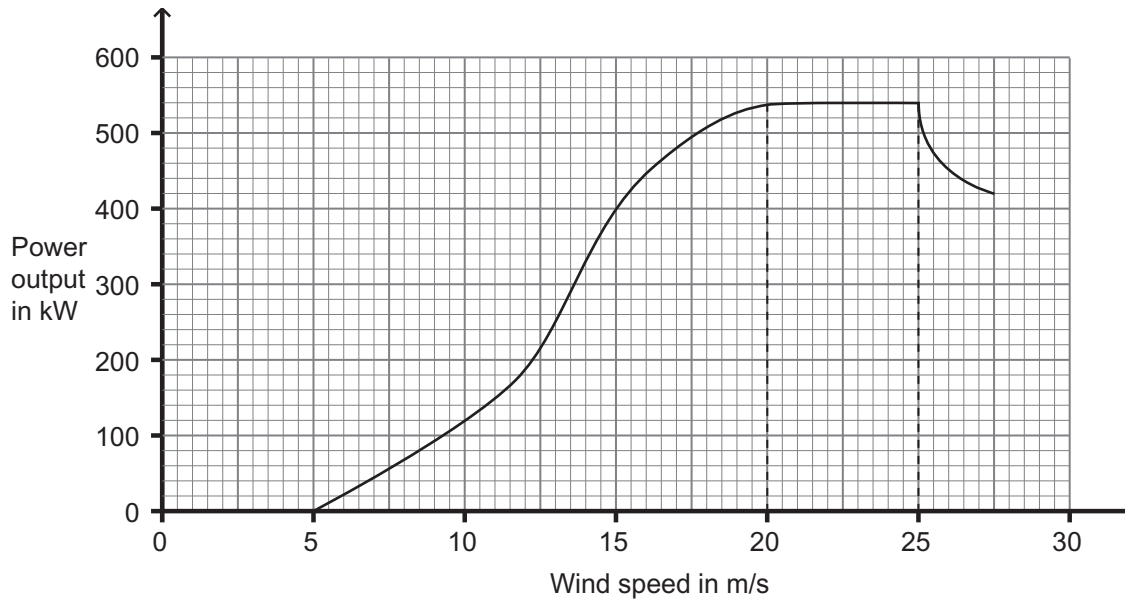
Feature	Conduction	Convection	Radiation
Plastic Lid	✓	✓	
Silvered Surfaces			
Vacuum			

[3]

Examiner Only	
Marks	Remark
○	○

- 8 To increase the amount of electricity generated in Northern Ireland using renewable energy resources would probably involve constructing many new wind turbines.

The graph shows how the power output of a wind turbine varied with wind speed.



- (i) Using the graph, describe in detail how the power output of a turbine varies with the wind speed.

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[3]

- (ii) State **one** disadvantage of using wind turbines to generate a high proportion of the electricity required in Northern Ireland.

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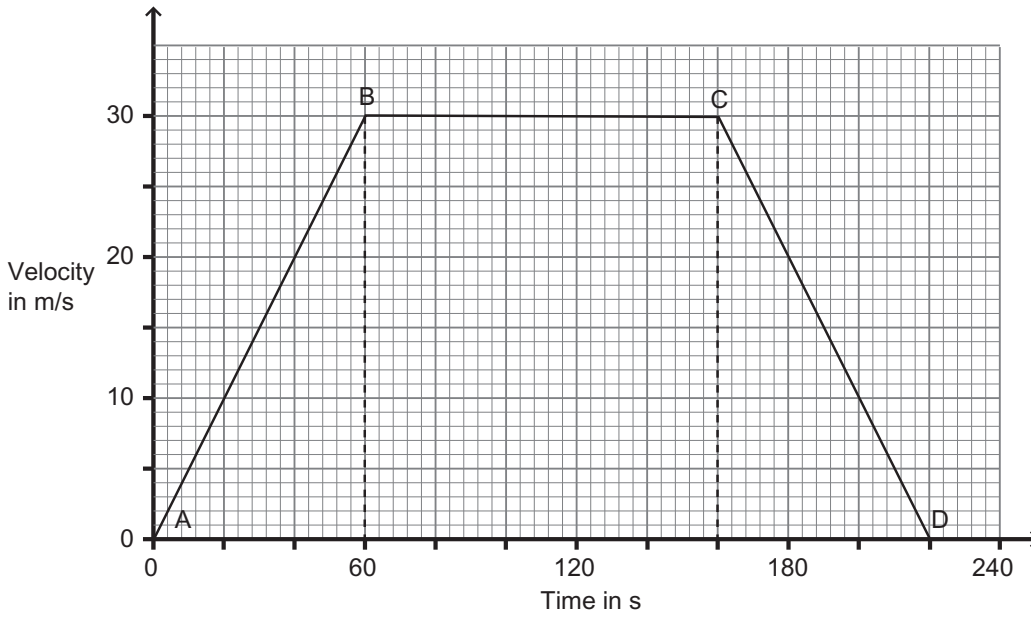
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[1]

Examiner Only	
Marks	Remark
○	○



9 The velocity-time graph below shows the motion of a car on a straight road.



(a) Tick (✓) the correct answer describing the motion of the car

The car has changed direction at C

The car is stationary during BC

The car is travelling at a steady velocity during BC

[1]

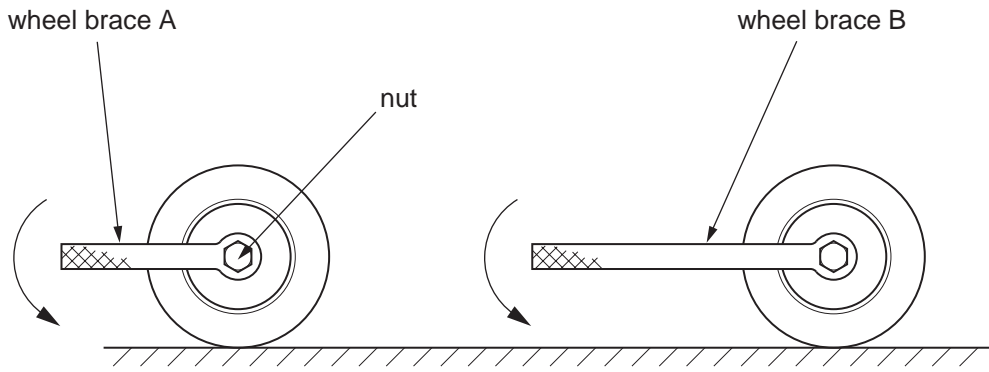
(b) Find the displacement of the car in the first 60 seconds of its motion.

**You are advised to show your working out.**

Displacement = \_\_\_\_\_ m [3]

Examiner Only	
Marks	Remark
○	○

10 A wheel brace is used to loosen wheel nuts when changing car wheels.



(a) Explain why it is easier to loosen the nut using wheel brace B.

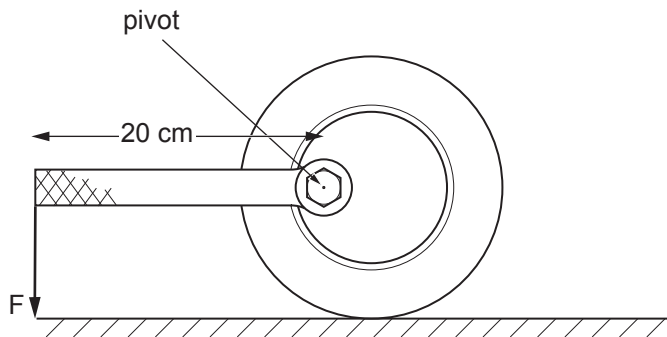
\_\_\_\_\_

\_\_\_\_\_ [1]

(b) A different wheel brace is used to loosen a wheel nut. The turning effect is 72 Nm.

Find the size of the force F.

**You are advised to show your working out.**



Force F = \_\_\_\_\_ N [2]

Examiner Only	
Marks	Remark
○	○

11 Patricia, who has a mass of 70 kg, rides a bicycle of mass 45 kg.



(a) Calculate the acceleration produced by the resultant force of 230 N.

**You are advised to show your working out.**

Acceleration = \_\_\_\_\_ m/s<sup>2</sup> [3]

(b) Describe and explain the effect on the size of the acceleration if Patricia sat upright on the bicycle, assuming the forward force is constant.

Description:

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Explanation:

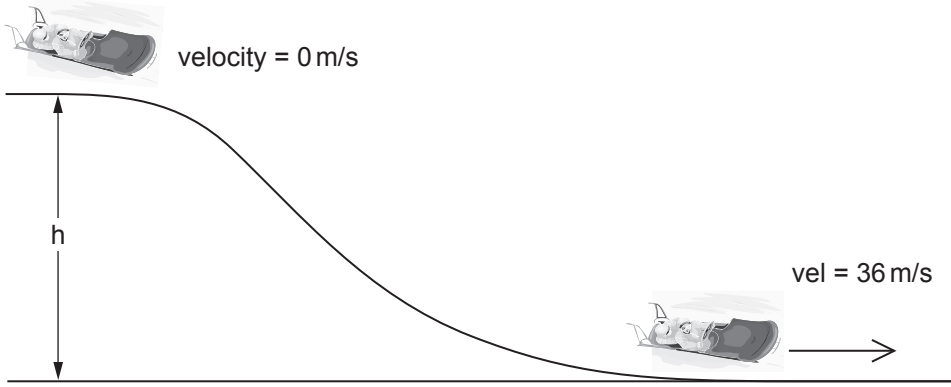
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[2]

Examiner Only	
Marks	Remark
○	○

12 A sleigh goes down a hill from rest.



It has a mass of 200 kg and reaches a velocity of 36 m/s at the bottom of the hill.

(a) Calculate the Kinetic Energy of the sleigh at the bottom of the hill.

**You are advised to show your working out.**

$$\text{KE} = \text{_____ J [3]}$$

(b) Use the principle of conservation of energy and your answer to (a) to calculate the height of the hill  $h$ .

**You are advised to show your working out.**

$$\text{Height (h)} = \text{_____ m [3]}$$

Examiner Only	
Marks	Remark
○	○

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**THIS IS THE END OF THE QUESTION PAPER**

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