Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2010–2011

Science: Double Award (Modular)

Forces and Energy
End of Module Test
Higher Tier

C

[GDC02]

GDC02

FRIDAY 20 MAY 2011, 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.

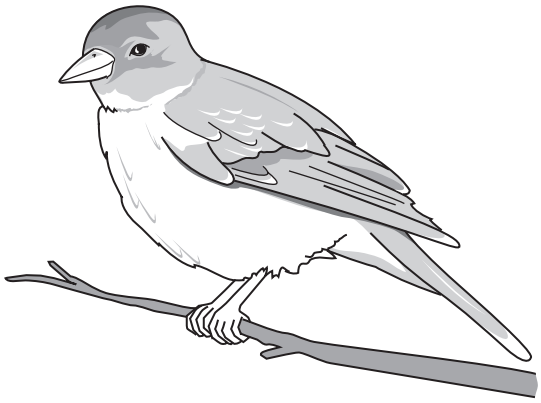
INFORMATION FOR CANDIDATES

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	

Examiner Only	
Marks	Remark

1 In winter, birds ruffle their feathers to keep themselves warm as shown in the diagram below.

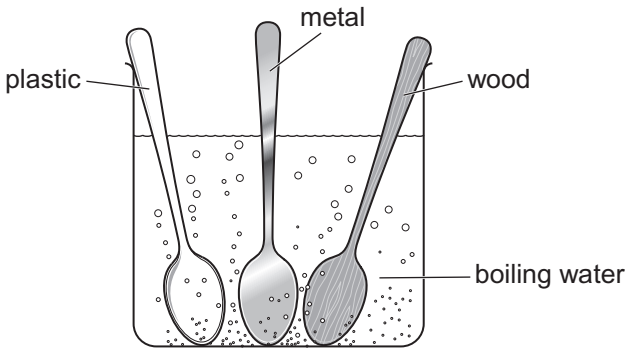


(a) Explain fully how the ruffling of feathers can help keep a bird warm.

_____

_____ [2]

Three spoons, one plastic, one wooden and the other metal, are placed in a beaker containing boiling water.



(b) (i) Which spoon feels warmest to touch?

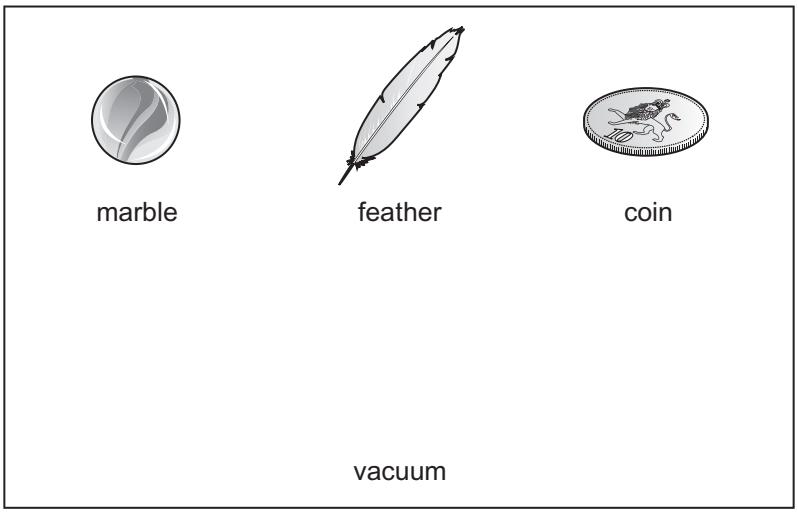
_____ [1]

(ii) Explain your answer.

_____

_____ [1]

2 Three objects are released in a chamber from which all the air has been removed. The objects are released at the same instant and from the same height.



(i) Which **one** of the following statements describes what will happen?

A The feather will hit the bottom first.
B They will not move.
C They will all hit the bottom at the same instant.
D The marble will hit the bottom first.
E The coin will hit the bottom first.

Letter _____ [1]

(ii) Give a reason for your choice.

_____

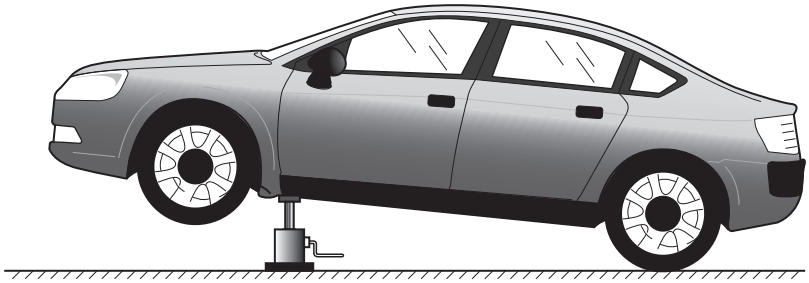
_____ [1]

(iii) Which object would hit the bottom last if air had been introduced into the chamber?

_____ [1]

Examiner Only
Marks | Remark

3 A car jack is used to raise a car so that the wheel can be changed. The useful work done in lifting the car is 1200 J.



(a) When using the car jack, the mechanic uses 3000 J of energy to lift the car.
Calculate the efficiency of the car jack.

You are advised to show clearly your working out.

Efficiency = _____ [3]

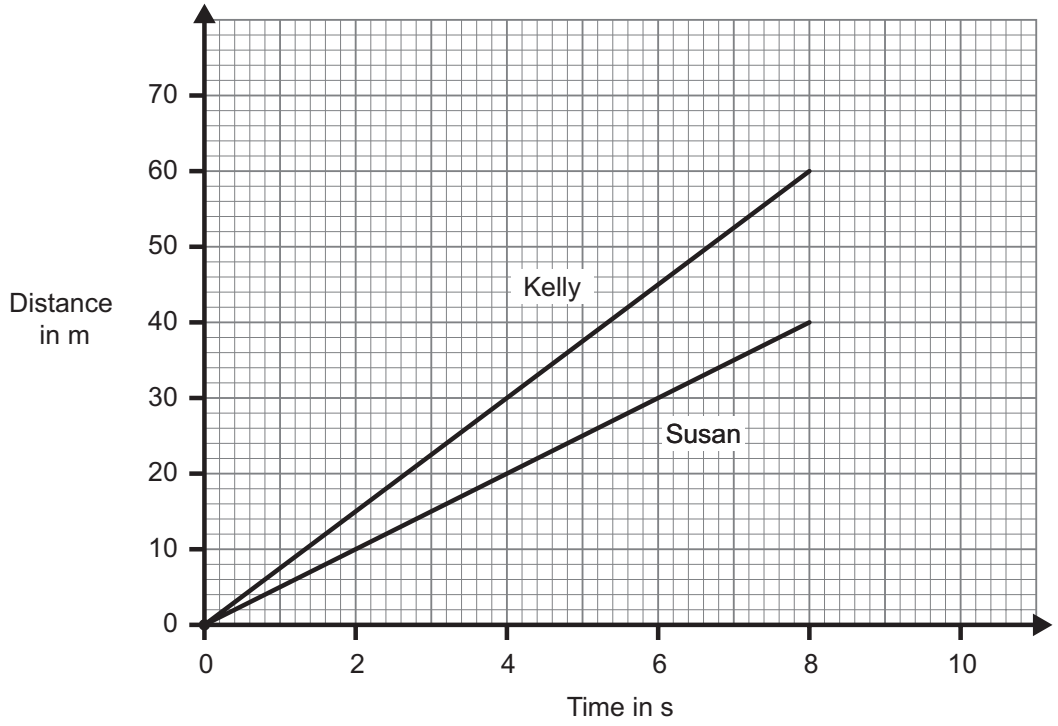
(b) What fraction of input energy is wasted?

_____ [1]

Examiner Only

Marks	Remark

4 Below is the distance–time graph for two runners, Kelly and Susan.



(a) How far apart are Kelly and Susan after 8 seconds?

_____ [1]

(b) Use the graph to calculate Kelly's speed.

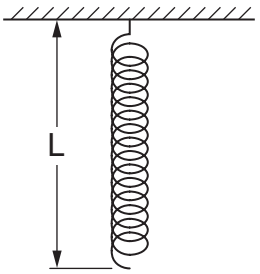
You are advised to show your working out.

Speed = _____ m/s [3]

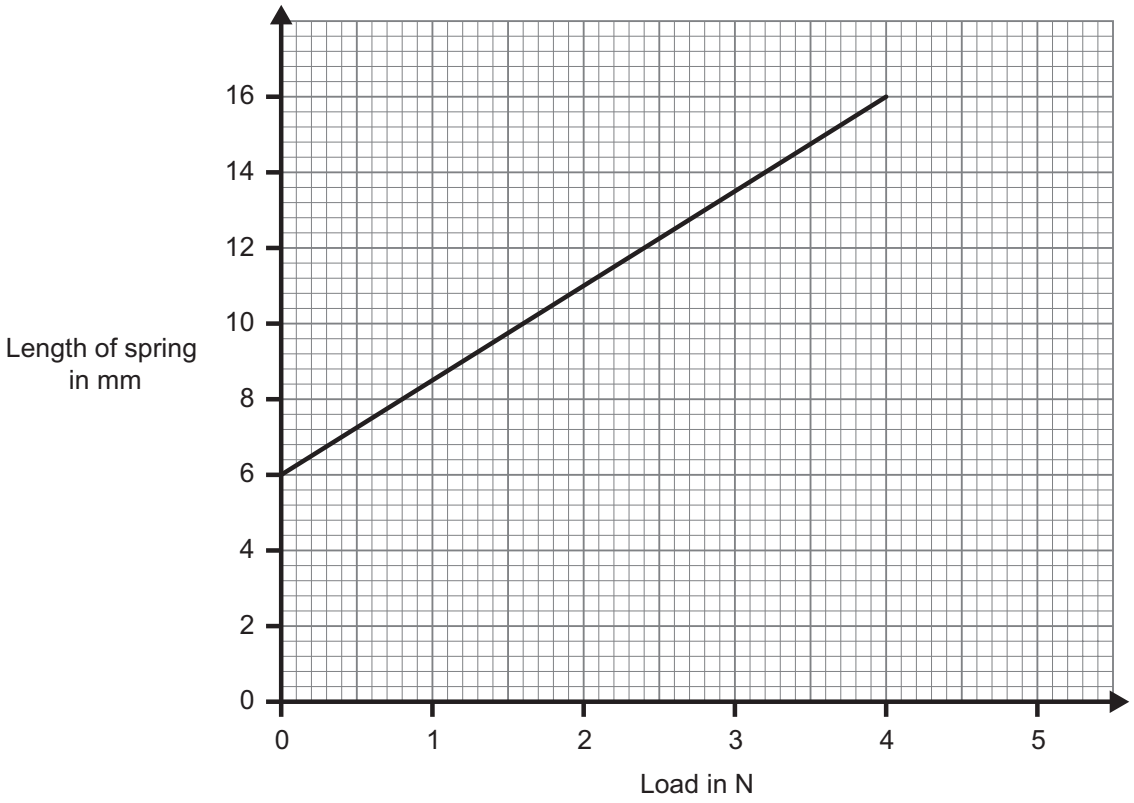
Examiner Only

Marks	Remark

5 Robert carries out a Hooke's Law experiment using a spring of length L.



He plots his results on a graph as shown below.



Use the graph to answer the following questions.

(a) (i) What is the unstretched length, L, of the spring?

L = _____ mm [1]

(ii) Robert could have tested Hooke's Law by plotting a more suitable graph. What should he have plotted on the vertical axis?

_____ [1]

Examiner Only

Marks	Remark

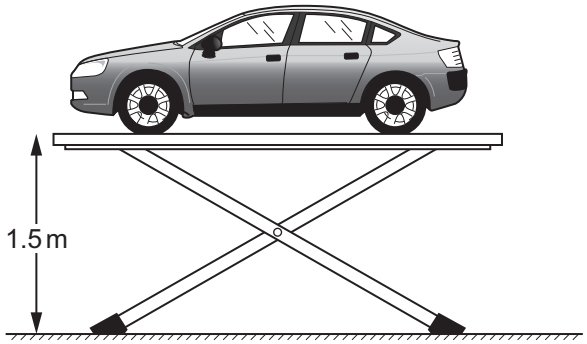
(b) An unknown load is hung on the spring and the extension produced is 10 mm. Use the graph to find the unknown load.

You are advised to show your working out.

Load = _____ N [2]

Examiner Only	
Marks	Remark

6 A garage lift is used to raise a car of mass 2500 kg a distance of 1.5 m.



(a) Calculate the work done by the garage lift.

You are advised to show your working out.

Work done = _____ J [3]

(b) The garage lift uses 42 000 J of energy to raise another car in 30 seconds. Calculate the power developed by the garage lift.

You are advised to show your working out.

Power = _____ W [3]

Examiner Only

Marks	Remark

7 The table gives a list of different energy sources used in electricity generating stations in the U.K.

For each energy source tick (✓) the box which applies **most** particularly to the source. Tick only **one** box on each row.

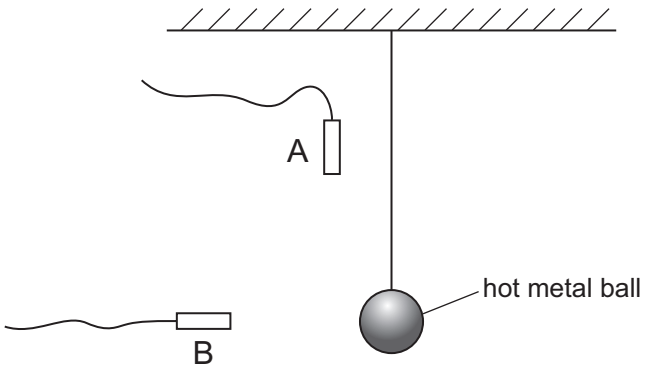
Energy source	Highest decommissioning costs	Lowest operating costs	Fossil fuel which responds most quickly to demand	Contributes most to the greenhouse effect
Gas				
Hydroelectric				
Coal				
Nuclear				

[4]

Examiner Only

Marks | Remark

8 Donal performs an experiment on heat transfer in the laboratory. A hot metal ball is suspended as shown close to two heat sensors, A and B.



(a) The sensors are **equal distances** from the hot ball. Explain fully why sensor A gives a higher reading than sensor B.

_____

_____ [2]

(b) The experiment is repeated but this time the apparatus is contained in a vacuum.

(i) How does the reading of sensor A now compare with the reading of sensor B?

_____ [1]

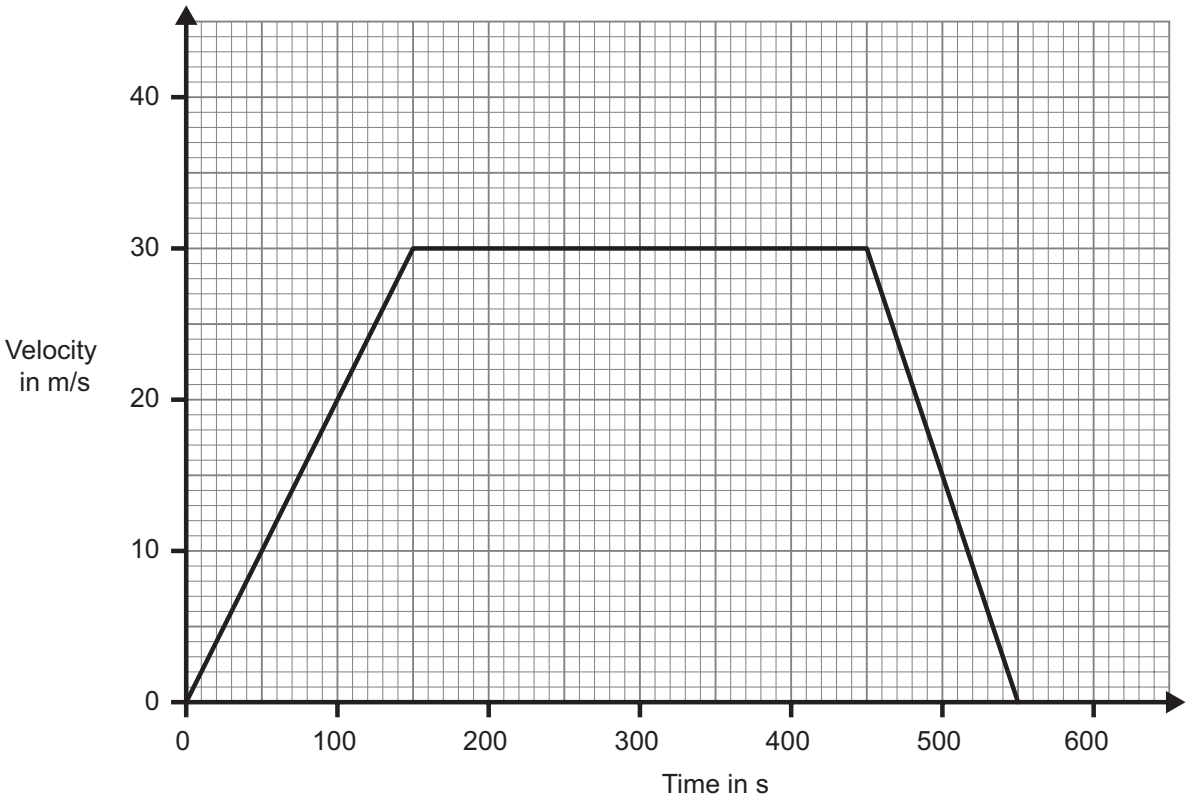
(ii) Explain your answer.

_____ [1]

Examiner Only

Marks	Remark

9 The velocity–time graph below represents the motion of a train between two stations.



(a) Complete the following to indicate when the train was

(i) Decelerating

From time t = _____ s to time t = _____ s [1]

(ii) Moving at constant velocity

From time t = _____ s to time t = _____ s [1]

(b) Calculate the acceleration of the train in the first 150 seconds of its journey.

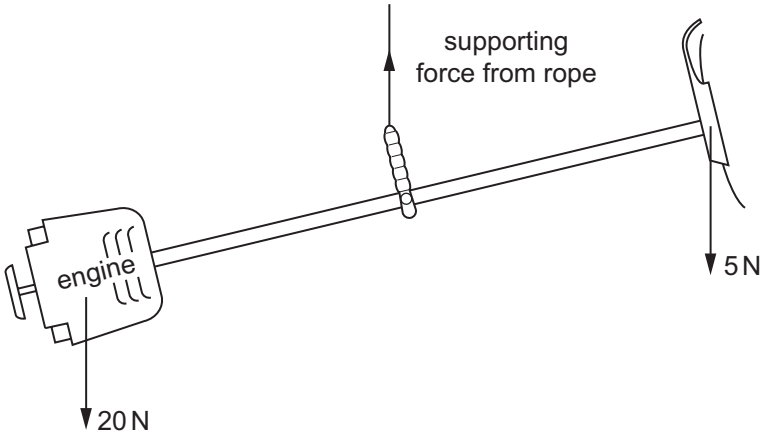
You are advised to show your working out.

Acceleration = _____ m/s^2 [3]

Examiner Only

Marks	Remark

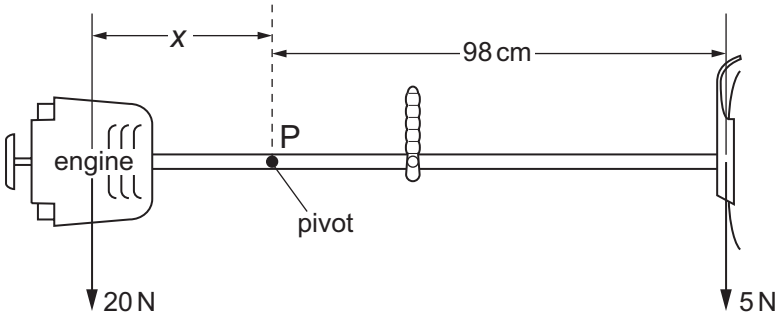
10 A garden strimmer is suspended with a rope. The forces acting on the strimmer are as shown in the diagram below.



(a) Find the size of the supporting force.

Supporting force = _____ N [1]

The owner balances the strimmer when carrying it, at the point P on the shaft.



(b) Use the principle of Moments to find the distance *x* from the pivot to the engine.

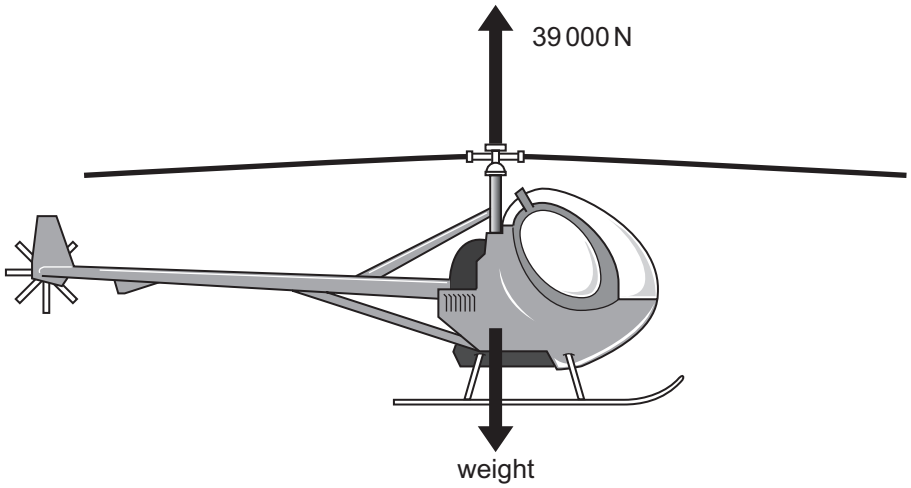
You are advised to show your working out.

Distance = _____ cm [3]

Examiner Only

Marks	Remark

11 A helicopter of mass 3000 kg accelerates upwards.



The upwards thrust exerted by the blades of the helicopter is 39 000 N.
The mass of the helicopter is 3000 kg.
Use Newton's Second Law to calculate the acceleration of the helicopter.

You are advised to show your working out.

Acceleration = _____ m/s^2 [4]

Examiner Only
Marks | Remark

12 In hitting a golf ball Rory gives it 50 J of kinetic energy.

The mass of the golf ball is 0.15 kg.

(i) Calculate the velocity of the golf ball immediately it leaves the club face.

You are advised to show your working out.

Velocity = _____ m/s [3]

(ii) State the useful work done by Rory.

Useful work = _____ J [1]

Examiner Only	
Marks	Remark

THIS IS THE END OF THE QUESTION PAPER

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