Rewarding Learning

| Centre Number | |
|---|---|
| 71 | |

| Candidate Number |
|---|
| |

General Certificate of Secondary Education
2009–2010

# Science: Double Award (Modular)

## Forces and Energy
## End of Module Test
## Higher Tier

**C**

**[GDC02]**

GDC02

**THURSDAY 20 MAY 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.

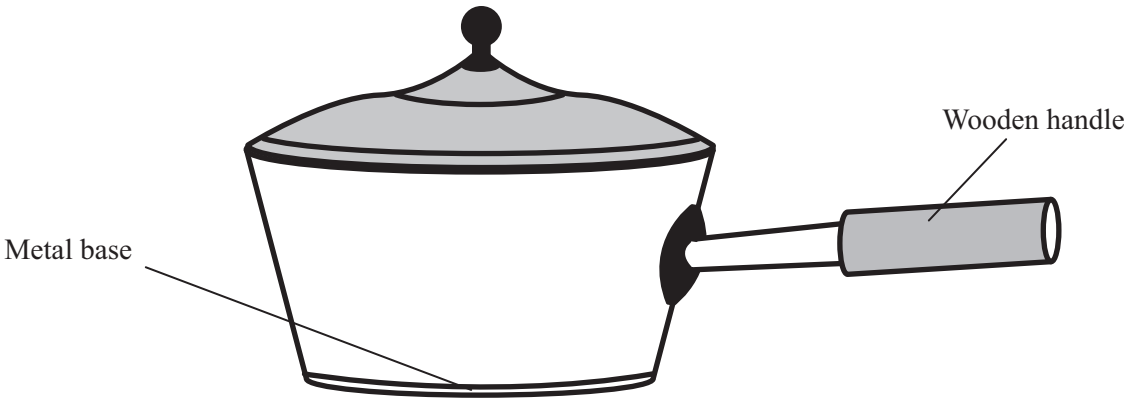
## INFORMATION FOR CANDIDATES

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** | |

| Examiner Only | |
|---|---|
| Marks | Remark |
| | |

**1** **(a)** The diagram below shows a saucepan designed to cook food.




**(i)** Why is copper a suitable metal for the base of the saucepan?

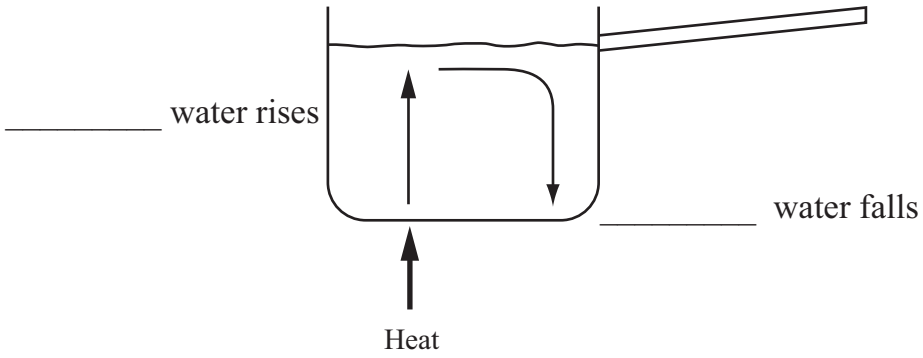
_____ [1]

**(ii)** Why is the handle of the saucepan made of wood?

_____ [1]

**(b)** This diagram shows how water in the saucepan becomes hot.

**(i)** Complete the labels on the diagram.




[2]

**(ii)** Complete the following sentence.

The movement of the water in the saucepan is called a

_____ current. [1]

**2** **(a)** The table below gives information about three balls. Complete the table.

| Ball | Mass | Weight |
|---|---|---|
| glass | 50 g | 0.5 N |
| brass | 250 g | |
| steel | | 2.0 N |

[2]

The three balls are dropped from the same height at the same instant.

**(b)** Which ball, if any, will hit the ground first? (Assume air resistance can be ignored.)

Tick (✓) the correct box.

The glass ball will hit the ground first. ☐

The brass ball will hit the ground first. ☐

The steel ball will hit the ground first. ☐

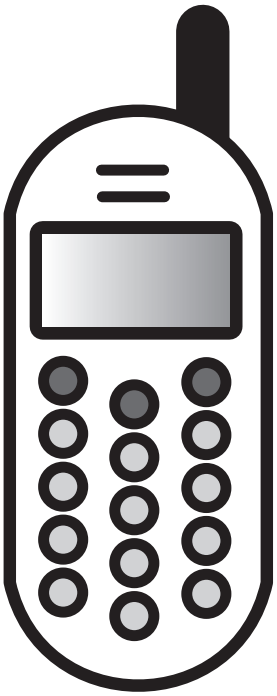
They all hit the ground at the same instant. ☐ [1]

Examiner Only

| Marks | Remark |
|---|---|
| | |

| Examiner Only | |
|---|---|
| Marks | Remark |
| | |

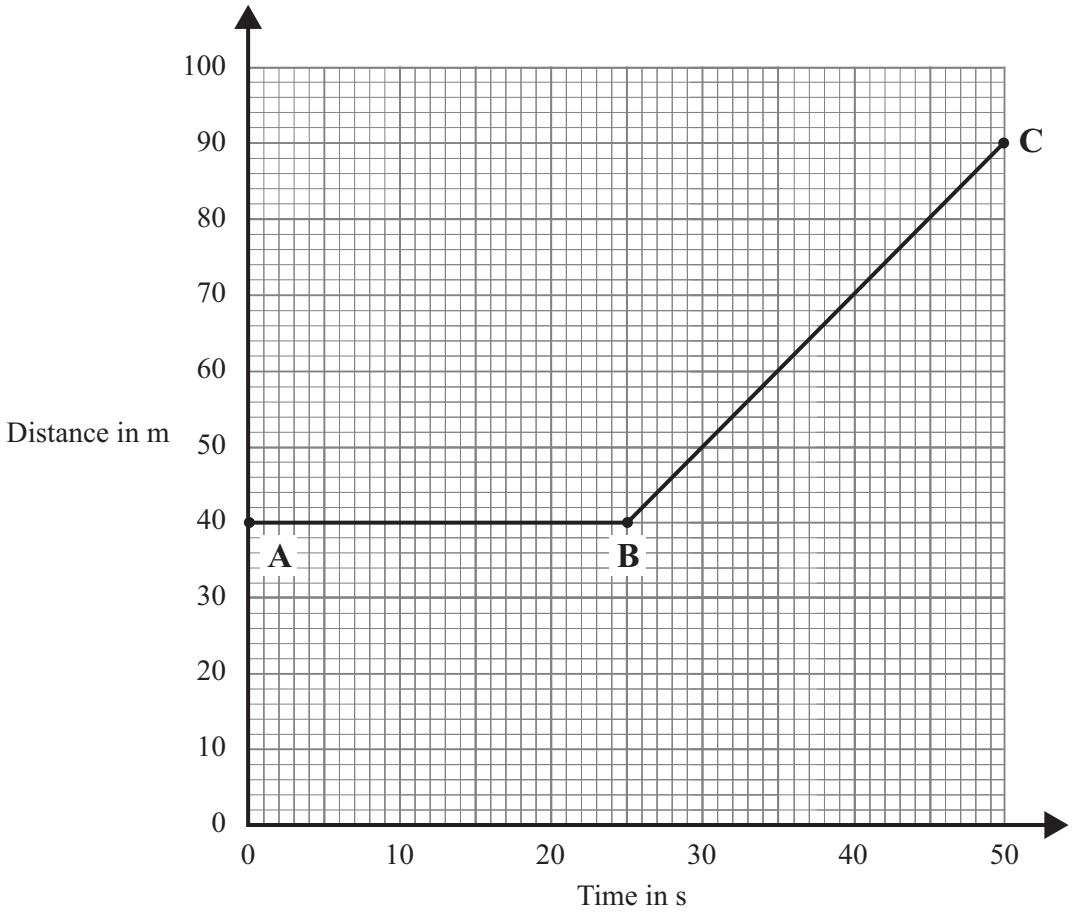
**3** A mobile phone **wastes** 5 J of energy as heat when the input electrical energy is 25 J.



Find the useful output energy and use your answer to calculate the efficiency of the mobile phone.
**You are advised to show your working out.**

Efficiency = _____ [4]

**4** The distance–time graph for a train is shown below.




**(i)** Describe the motion of the train from:

**A to B**. _____

_____

**B to C**. _____

_____[2]

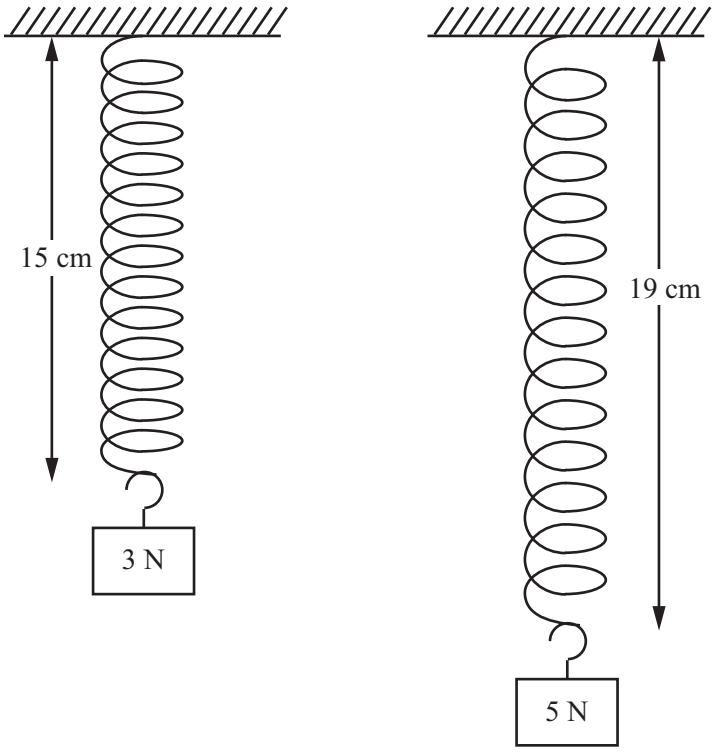
**(ii)** Calculate the average speed of the train between **B and C**.
**You are advised to show your working out.**

Average speed = _____ m/s [3]

Examiner Only

| Marks | Remark |
|---|---|
| | |

**5** When a load of 3 N hangs from a spiral spring, its total length is 15 cm. When the load is 5 N, the total length is 19 cm.




**(i)** What extension would be caused by a load of 1 N?
**You are advised to show your working out.**

Extension = _____ cm [2]

**(ii)** Calculate the natural (unextended) length of the spring.
**You are advised to show your working out.**

Natural (unextended) length = _____ cm [2]

Examiner Only
Marks | Remark

**6** The photograph shows the space shuttle *Discovery* taking off.

© *NASA*

**(a)** The work done by the engines of the space shuttle during lift-off is 9 400 000 J. This takes the space shuttle 5 seconds.
Calculate the average power generated by the engines during lift-off.
**You are advised to show your working out.**

Average power = _____ W [3]

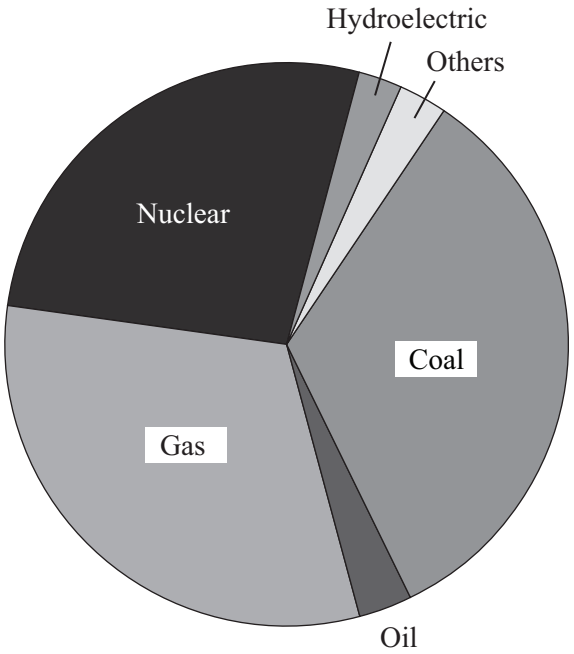
**(b)** One of the engines in the space shuttle exerts a force of 11 750 N. In this time interval of 5 seconds, the space shuttle rises to a height of 200 m.
Calculate the work done by this engine.
**You are advised to show your working out.**

Work done = _____ J [3]

Examiner Only

| Marks | Remark |
|---|---|
| | |

**7** The chart shows the sources used to generate electricity in the United Kingdom in 2002.




**(i)** Which resource would have provided the lowest running costs?

Answer _____ [1]

**(ii)** Which resource would have resulted in the greatest de-commissioning costs?

Answer _____ [1]

**(iii)** Which named resource does not ultimately depend on the energy of the sun?

Answer _____ [1]

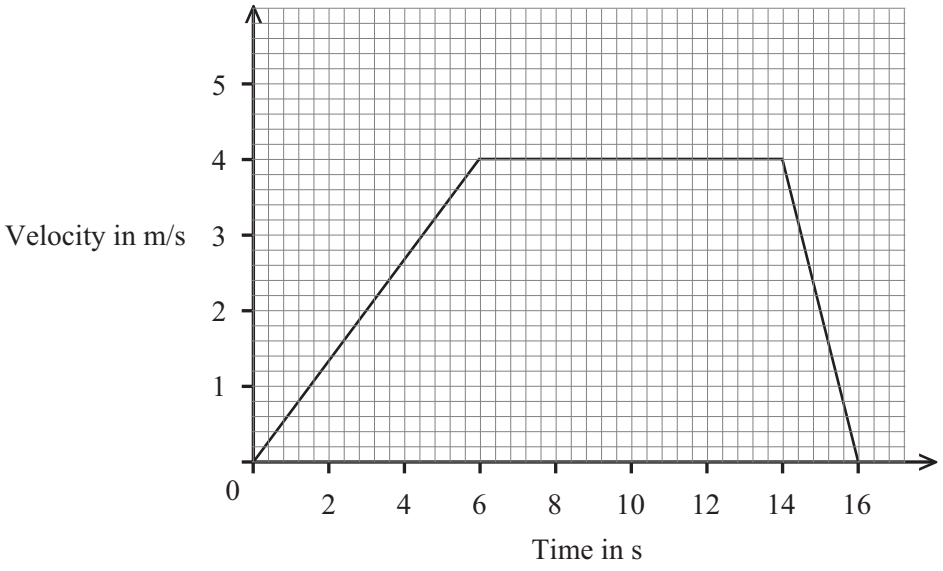
**(iv)** Name a renewable resource which could be included in the 'Others' section in the chart.

Answer _____ [1]

Examiner Only

| Marks | Remark |
|---|---|
| | |

**8** The velocity–time graph for a toy car is shown.




The toy car has a mass of 500 g.

Calculate the maximum momentum of the car in kg m/s.

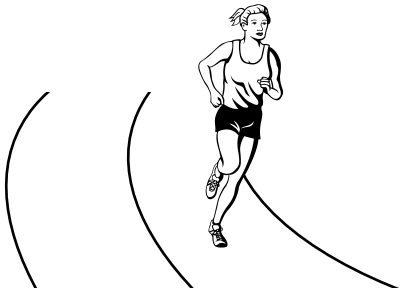
**You are advised to show clearly your working out.**

Maximum momentum = _____ kg m/s [3]

Examiner Only

| Marks | Remark |
|---|---|
| | |

**9** Scarlett runs round a circular race-track at a constant speed of 4 m/s.



**(a)** Explain why her velocity is changing.

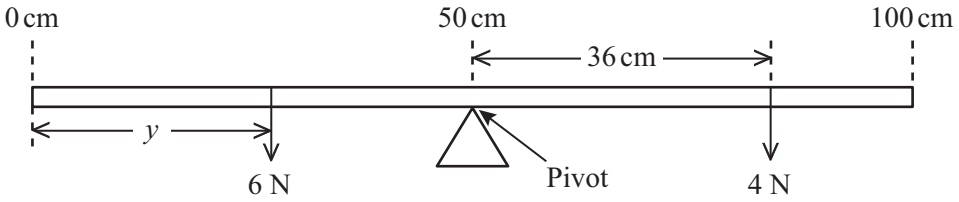
_____ [1]

**(b)** The circumference of the track is 300 m and Scarlett runs one lap.
How long will this take if she maintains a constant speed of 4 m/s?
**You are advised to show your working out.**

Time = _____ s [3]

| Examiner Only | |
|---|---|
| Marks | Remark |
| | |

**10** A uniform metre rule is pivoted at its mid-point. The markings on the metre rule start with the zero mark at the left-hand end as shown. A 4 N weight acts on the right-hand side 36 cm from the pivot.

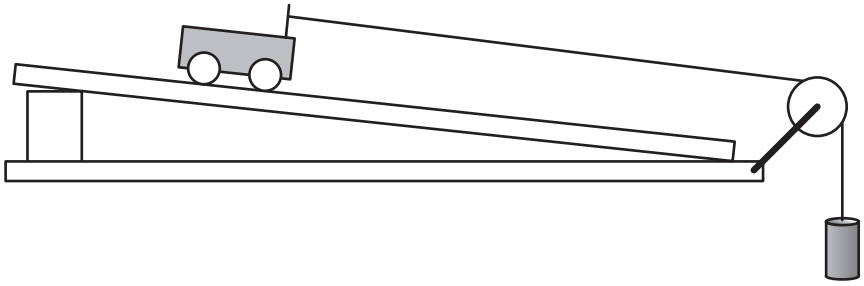



Use the principle of moments to calculate the distance $y$ from the 6 N force to the end of the metre stick.
**You are advised to show clearly your working out.**

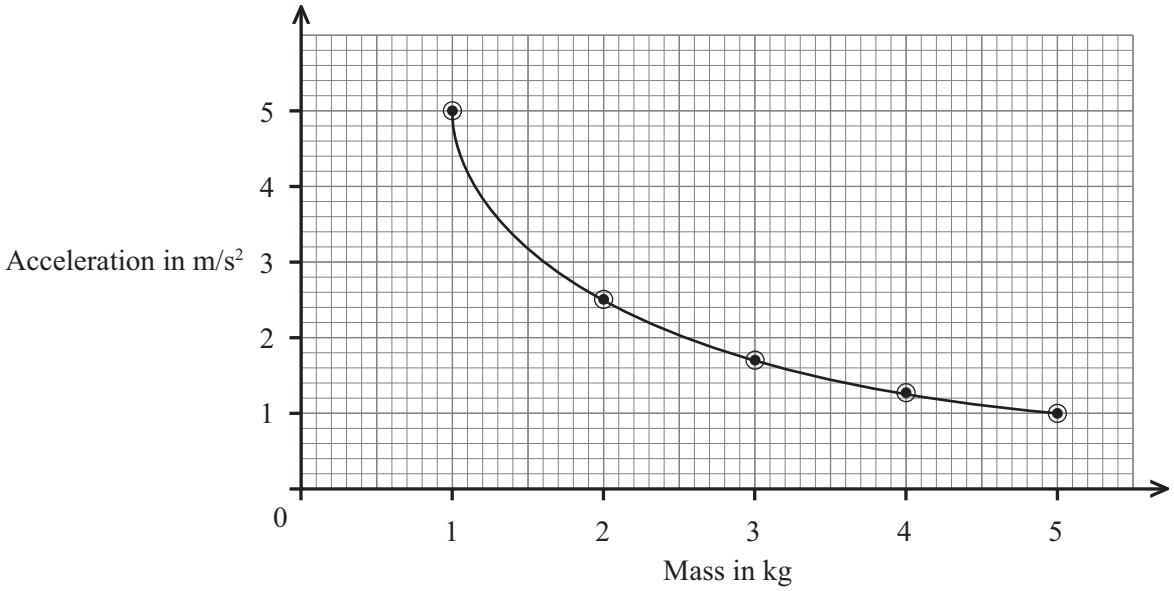
$y =$ _____ cm [4]

Examiner Only
Marks | Remark

**11** Flora carries out an experiment in the laboratory where trolleys of different masses are accelerated by the **same force** down a runway.



For each trolley, Flora records the acceleration and plots a graph of acceleration against mass. The graph is shown below.




**(a)** How can you tell from the graph that the acceleration is **not** directly proportional to the mass?

_____ [1]

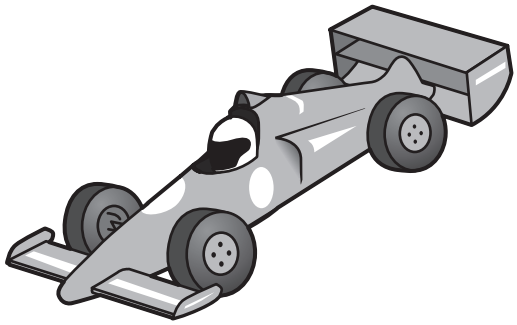
**(b)** Use the graph to calculate the size of the force.
**You are advised to show your working out.**

Force = _____ N [3]

Examiner Only
Marks | Remark

**12** A racing car of mass 1200 kg has a kinetic energy of 960 000 J.

| Examiner Only | |
|---|---|
| Marks | Remark |
| | |



Calculate the speed of the racing car.
**You are advised to show your working out.**

Speed = _____ m/s [4]

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

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