Rewarding Learning

Centre Number	
71	

Candidate Number

General Certificate of Secondary Education
2013–2014

Double Award Science: Physics

Unit P1

Foundation Tier

[GSD31]

GSD31

FRIDAY 15 NOVEMBER 2013, AFTERNOON

TIME

1 hour.

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 nine** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 70.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in question **7**.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total Marks	

Examiner Only	
Marks	Remark

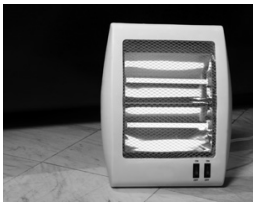
1 **(a)** A microphone is designed to change sound energy into electrical energy, as shown below.

Microphone

Sound energy	→	Electrical energy

Fill in the spaces below to show the type of energy change the device is designed to bring about.

(i)



Electric fire

Electrical energy	→	_____ energy

[1]

(ii)

Trampoline

_____ energy	→	Kinetic energy

[1]

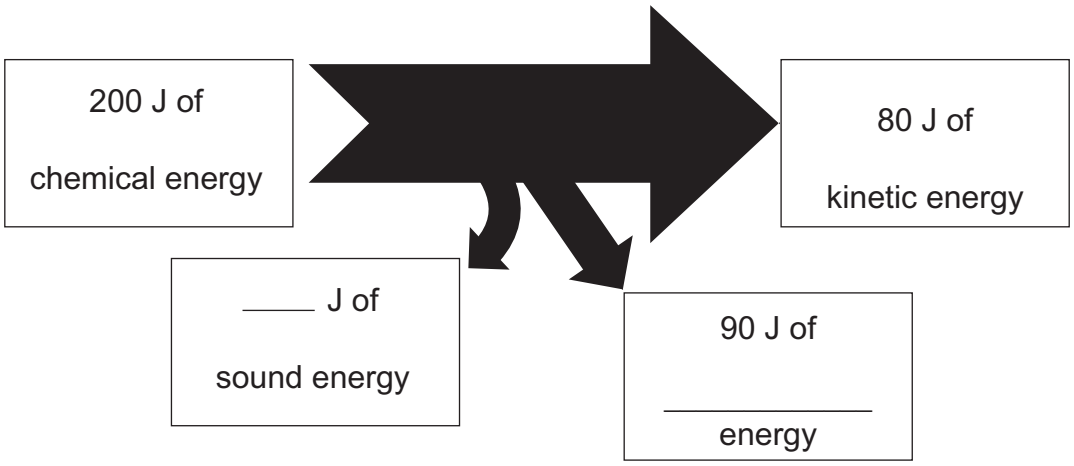
(iii)

Study lamp

_____ energy	→	Light energy

[1]

(b) An energy flow diagram for a diesel engine is shown below.



(i) Complete the energy flow diagram by filling in the boxes above. [2]

(ii) Calculate the efficiency of this diesel engine.

You are advised to show your working out.

Efficiency = _____ [3]

Examiner Only

Marks	Remark

2 Recently, the Chinese government decided to invest heavily in building nuclear power stations to generate electricity.

State two advantages and two disadvantages in building nuclear power stations.

Advantages

1. _____

2. _____ [2]

Disadvantages

1. _____

2. _____ [2]

Examiner Only	
Marks	Remark

3 An athlete can run 200 m in a time of 25.0 s.

© *iStock / Thinkstock*

(a) Calculate the average speed of the athlete.

You are advised to show your working out.

Average speed = _____ m/s [3]

(b) During the race, the athlete increases his velocity from 5.0 m/s to 8.0 m/s in a time of 2.0 s.

Calculate the acceleration of the athlete.

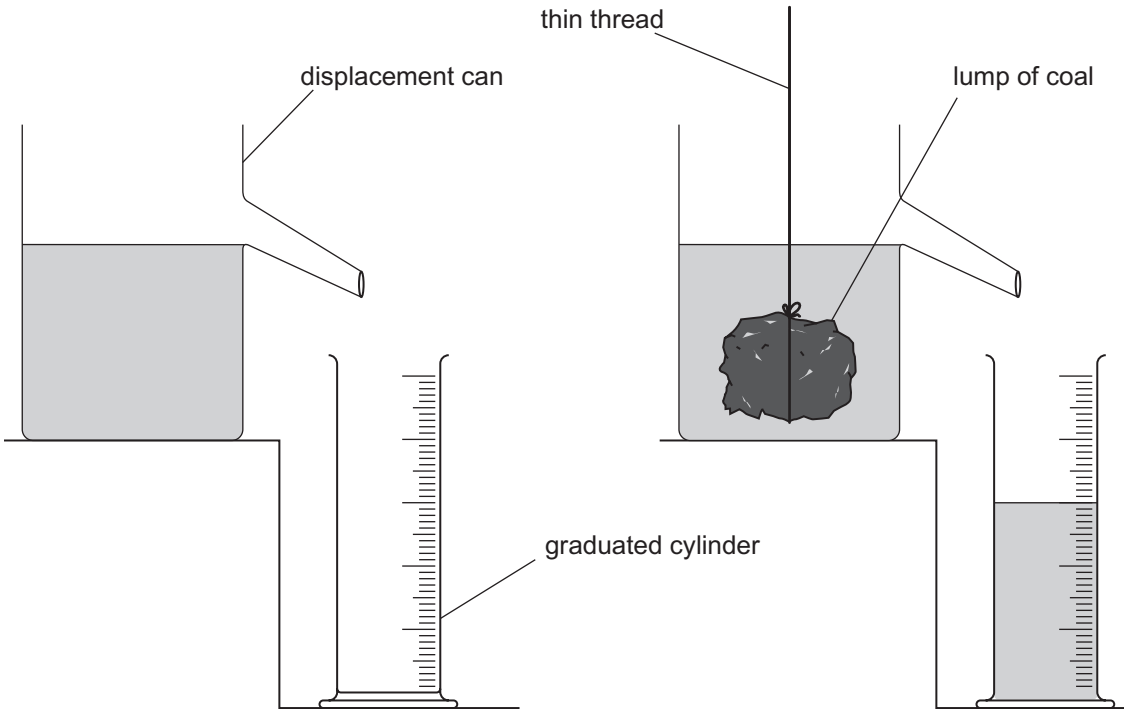
You are advised to show your working out.

Acceleration = _____ m/s^2 [4]

Examiner Only

Marks	Remark

4 **(a)** A student used the displacement method to find the density of coal.



The student records the results below.

Mass of coal = 900 g
Volume of water displaced = 125 cm^3

(i) Use the results to find the density of coal.

Remember to include the correct units.

You are advised to show your working out.

Density of coal = _____

Units = _____ [4]

Examiner Only

Marks	Remark

(ii) If a thick thread was used to lower the stone into the water, how would this affect the volume of water displaced?

_____

_____ [1]

(b) Give a reason why the density of solid materials, like coal, is greater than the density of liquids, like water.

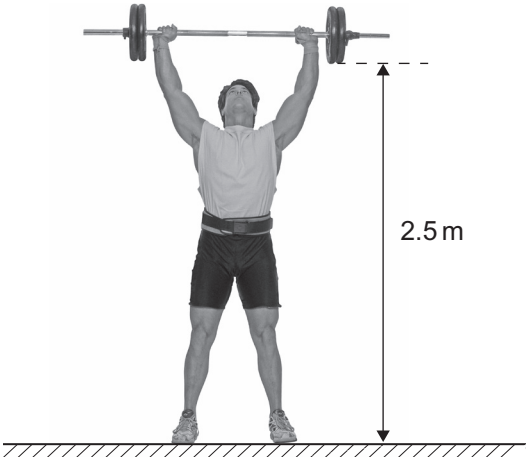
_____

_____ [1]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

5 During the Olympics, a weightlifter lifted a 140 kg bar from the floor to a height of 2.5 m.



© Comstock / Stockbyte / Thinkstock

(i) Calculate the weight of the bar.

Weight = _____ N [1]

The weightlifter uses a constant force to lift the bar 2.5 m above the floor.

(ii) Calculate the work done by the weightlifter.

You are advised to show your working out.

Work done = _____ J [3]

To achieve maximum points, the weightlifter must hold the bar stationary above his head for 2 seconds.

(iii) How much work is done on the bar during these two seconds?

Circle the correct answer.

0 280 900 1800 3500

Give a reason for your answer.

_____

_____ [2]

(iv) The weightlifter drops the bar of mass 140 kg to the ground. It hits the ground with a velocity of 7 m/s. Calculate the kinetic energy of the bar as it hits the ground.

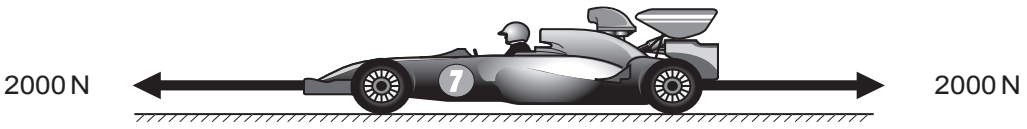
You are advised to show your working out.

Kinetic energy = _____ J [3]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

6 The diagram below shows some of the forces acting on a racing car which is moving forwards.



(i) Describe the movement of this racing car.

_____ [1]

The forwards force is increased to 3600 N, the backwards force remains constant at 2000 N.

(ii) Describe fully the movement of the racing car.

_____

_____ [2]

(iii) Calculate the size of the resultant force acting on the racing car.

Resultant force = _____ N [1]

The mass of the racing car is 800 kg.

(iv) Use the formula:

$$\text{acceleration} = \frac{\text{resultant force}}{\text{mass}}$$

to calculate the acceleration of the racing car.

You are advised to show your working out.

Acceleration = _____ m/s^2 [2]

7 The modern theory for the structure of the atom is quite different from the earlier theory which it replaced.

Write a brief account of both theories.

Your discussion should include:

- the name of each theory; and
- a description of how the particles are arranged in each theory.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

8 **(a)** The symbol for Uranium-235 is

$$^{235}_{92}U$$

(i) How many protons does a nucleus of Uranium-235 contain?

_____ [1]

(ii) What name is given to this number of protons?

_____ [1]

(iii) How many neutrons does a nucleus of Uranium-235 contain?

_____ [1]

(iv) What name is given to the total number of protons and neutrons in the nucleus of Uranium-235?

_____ [1]

(b) Radioactive materials emit radiations which have particular natures and properties.

Complete the table below, linking the radiations to their natures and properties. One arrow has been inserted for you.

Use only **five** straight arrows.

Nature of radiation	Name of radiation	Property of radiation
Helium nuclei	• alpha •	Is absorbed by a few cm of air
High frequency electromagnetic radiation	• beta •	Can penetrate 3 cm of lead
High speed electrons	• gamma •	Can penetrate a thick piece of card, but not 3 cm of lead

[5]

(c) Nuclear reactors rely on the fission of Uranium-235.

(i) What is the first stage of the nuclear fission process?

_____

_____

_____ [2]

(ii) What happens during the nuclear fission process?

_____

_____

_____ [2]

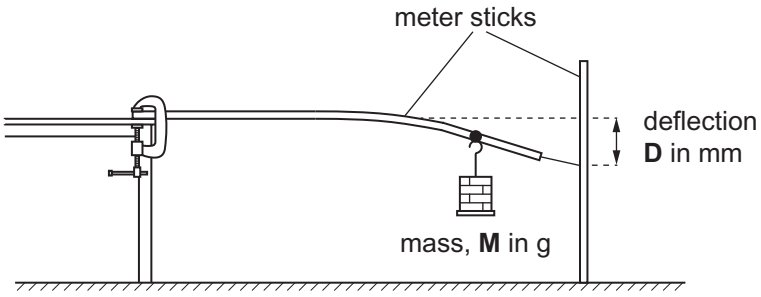
(iii) What is the name of the particle which sustains the chain reaction?

_____ [1]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

9 Gillian is investigating “bending beams”. She uses the apparatus shown below.



According to theory, the mathematical relationship between the deflection (**D**) of the beam and the mass (**M**) hung from the beam is given by

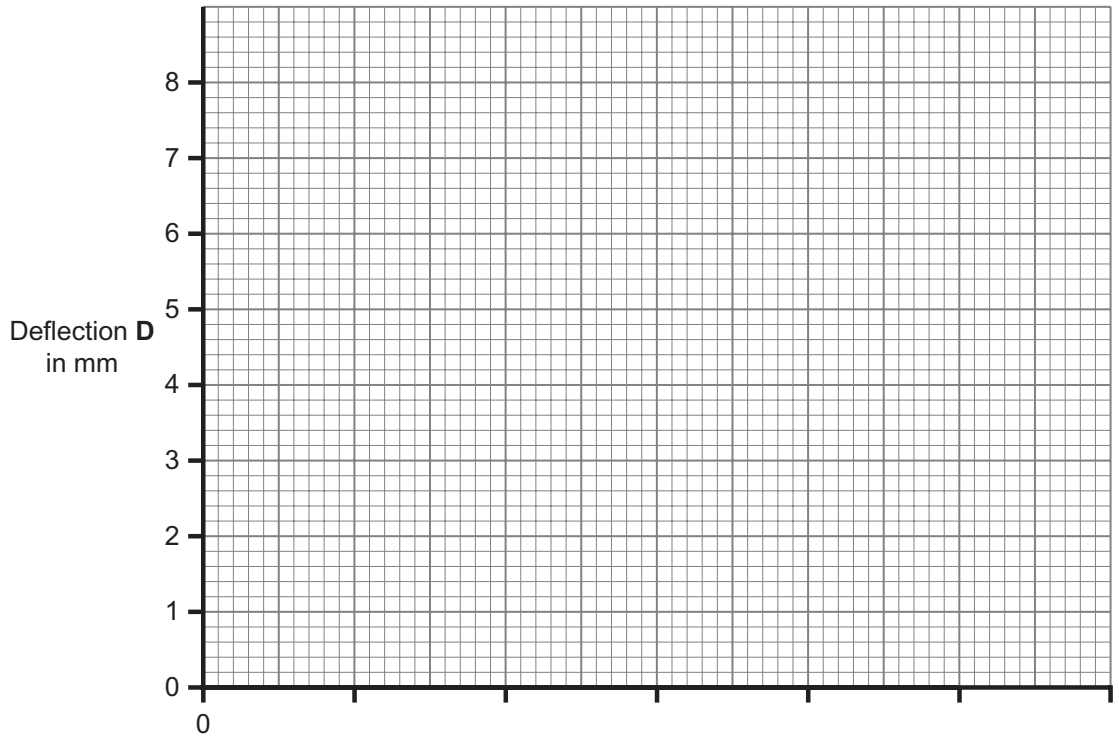
$$\mathbf{D = k\,M} \qquad \textbf{Equation 9.1}$$

The results Gillian collected are as follows.

Mass M in g	Deflection D in mm
50	1.5
100	3.0
150	4.5
200	6.0
250	7.5

Examiner Only	
Marks	Remark

(a) Choose a suitable horizontal scale and label the horizontal axis. Plot a graph of **D** on the vertical axis versus **M** on the horizontal axis on the grid below.



[4]

(b) Draw a line of best fit. [1]

(c) **(i)** Use your graph to determine the constant k, in **Equation 9.1**.

Remember to include the unit for k.

k = _____: Unit = _____ [4]

(ii) Use your graph to find the deflection for a mass of 125 g.

Deflection = _____ mm [1]

THIS IS THE END OF THE QUESTION PAPER

Sources:
Microphone_105551541_iStockphoto_Thinkstock.com
Electric heater_158323664_iStockphoto_Thinkstock.com
Trampoline_153491970_iStockphoto_Thinkstock.com
Desk lamp_91649982_iStockphoto_Thinkstock.com

113998