| Surname | Centre Number | Candidate Number |
|---|---|---|
| Other Names | | 0 |

# GCSE

4463/01

## SCIENCE A/PHYSICS

## PHYSICS 1
## FOUNDATION TIER

P.M. THURSDAY, 16 January 2014

1 hour

| For Examiner's use only | | |
|---|---|---|
| **Question** | **Maximum Mark** | **Mark Awarded** |
| **1.** | **5** | |
| **2.** | **7** | |
| **3.** | **8** | |
| **4.** | **10** | |
| **5.** | **6** | |
| **6.** | **12** | |
| **7.** | **12** | |
| **Total** | **60** | |

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### ADDITIONAL MATERIALS

In addition to this paper you may require a calculator.

### INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

### INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

**A list of equations is printed on page 2**. In calculations you should show all your working.

You are reminded that assessment will take into account the quality of written communication (QWC) used in your answer to question **7***(c)*.

## Equations

| | |
|---|---|
| density = $\frac{\text{mass}}{\text{volume}}$ | $\rho = \frac{m}{V}$ |
| energy transfer = power × time | $E = Pt$ |
| units used (kWh) = power (kW) × time (h)<br>cost = units used × cost per unit | |
| % efficiency = $\frac{\text{useful energy [or power] transfer}}{\text{total energy [or power] input}} \times 100$ | |
| wave speed = wavelength × frequency | $c = \lambda f$ |
| speed = $\frac{\text{distance}}{\text{time}}$ | |

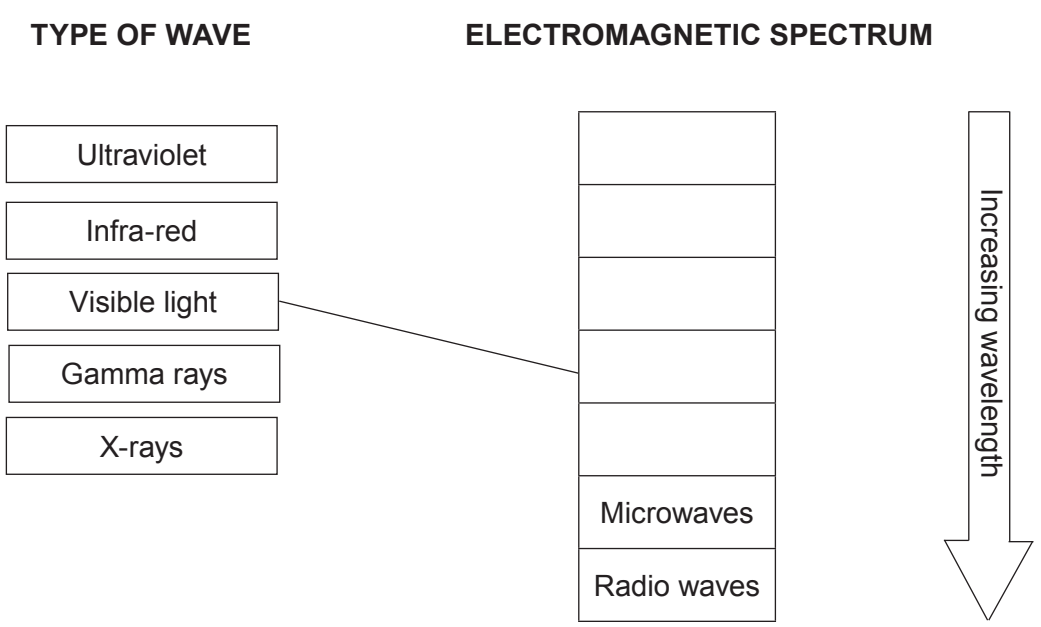
## SI multipliers

| Prefix | Multiplier | |
|---|---|---|
| m | $10^{-3}$ | $\frac{1}{1000}$ |
| k | $10^{3}$ | 1000 |
| M | $10^{6}$ | 1000000 |

Examiner only

*Answer* **all** *questions.*

**1.** *(a)* Draw a line from each type of wave on the left to show its correct position in the electromagnetic (em) spectrum.
**Draw 4 lines only. One has been done for you.** [3]




*(b)* (i) Microwave radiation is an em wave in the wavelength range 0.1 cm to 30 cm.
State **one** possible wavelength for a radio wave. [1]

Wavelength ..... cm

(ii) State **one** property that is the same for radio waves and microwaves. [1]

.....

5

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**Turn over.**

Examiner only

**2.** *(a)* In a laboratory, a radiation detector was placed in front of a radioactive source. The readings were carefully taken every minute and are shown below.

| Time (mins) | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Detector reading (counts) | 34 | 36 | 40 | 31 | 34 |

(i) Put a tick (✓) alongside the **one** correct reason below for the readings not being the same every minute. [1]

| | |
|---|---|
| Detector was probably not working properly. | |
| Radioactive decay is random. | |
| The source was faulty. | |
| The times were not carefully measured. | |
| The detector was moved nearer the source in the 5 minutes. | |

(ii) Calculate the mean number of counts every minute. [2]

Mean counts = .....

(iii) State how the method used above could be changed to find the count rate of the background radiation in the laboratory. [1]

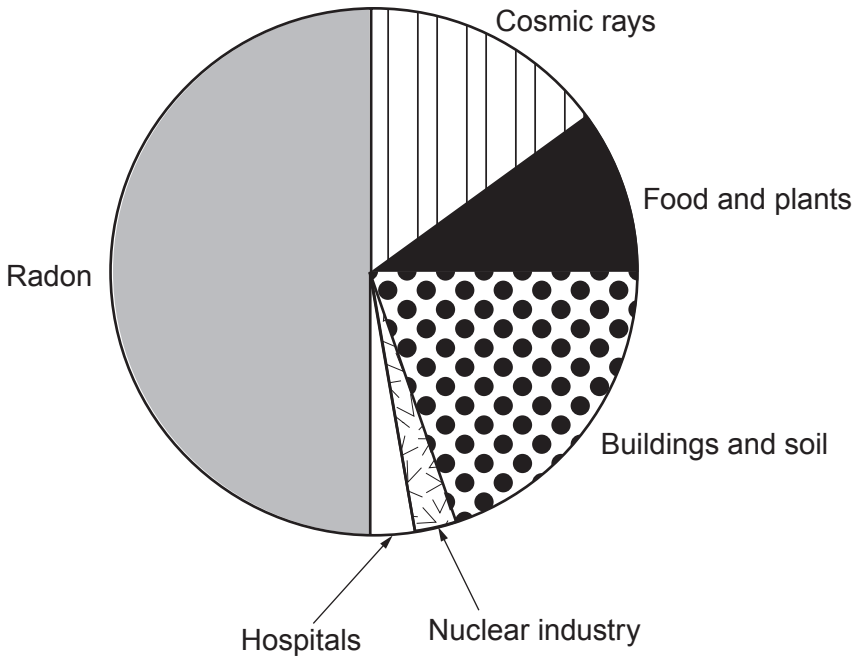
.....

.....

Examiner only

*(b)* The sources of background radiation are shown in the pie chart below.

**Sources of background radiation**




(i) Use the information in the pie chart to answer the questions that follow.

(I) Name the background source that gives the same percentage as hospitals. [1]

.....

(II) State the percentage of background radiation that comes from radon. [1]

..... %

(ii) State the reason why the amount of radon varies across the country. [1]

.....

7

Examiner only

**3.** The following label is attached to the back of a microwave oven that also contains an electric grill.

| | | |
|---|---|---|
| 230 V | ~ | 50 Hz |
| Microwave power | | 1.2 kW |
| Grill power | | 1.8 kW |

*(a)* Use the information on the label to complete the following statement. [3]

The mains electricity supply in the home is ..... volts which has a frequency of ..... . The power of the grill is ..... watts.

*(b)* Name the **two** types of electromagnetic waves that the oven uses to cook food. [2]

..... and .....

*(c)* The grill and microwave are used continuously to cook a small joint of meat.

(i) Write down the total power used to cook the meat. [1]

Total power = ..... kW

(ii) The cooking time is 0.5 hours. Use the equation:

units used (kWh) = power (kW) × time (h)

to calculate the number of units used to cook the meat. [1]

Units used = ..... kWh

Examiner only

(iii) Given that a unit of electricity costs 14 p, use the equation:

cost = units used × cost per unit

to calculate the cost of cooking the meat. [1]

Cost = ..... p

8



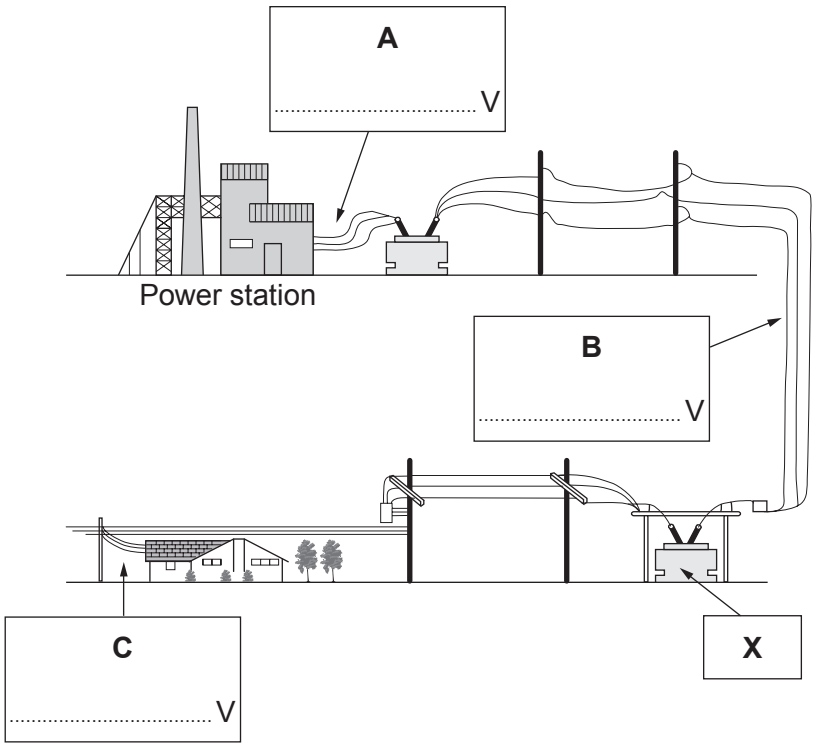




**Turn over.**

Examiner only

**4.** The diagram shows an electricity transmission network that connects power stations to users.




*(a)* (i) Give the name of this electricity distribution system. [1]

.....

(ii) Voltages used in the distribution of electricity are 400 000 V, 50 000 V and 230 V. Write the correct values **in the boxes A, B** and **C** on the diagram. [2]

(iii) Name the device that is labelled **X** on the diagram. [1]

.....

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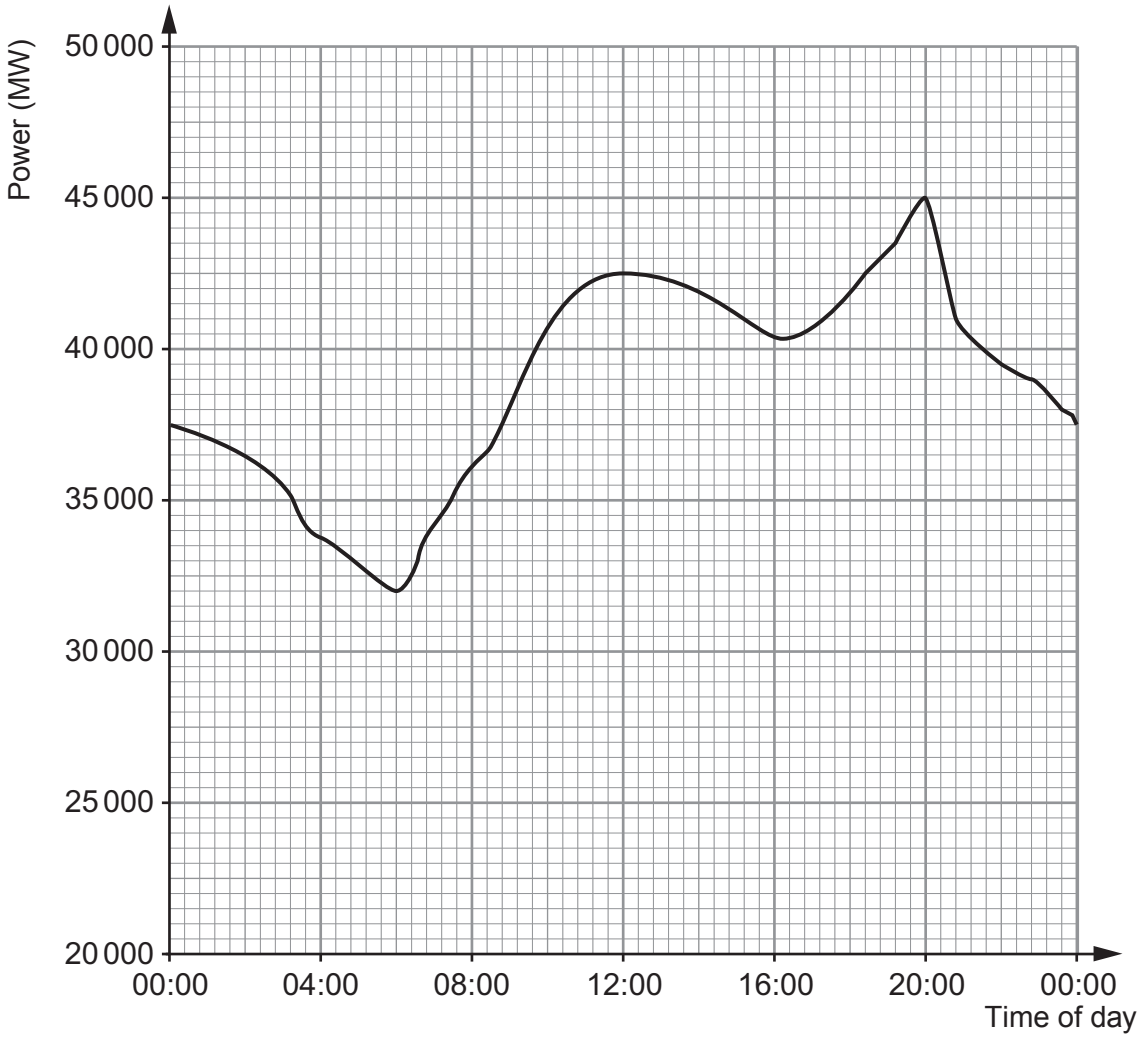
*(b)* In Britain, the demand for electricity in a day changes in the way shown on the graph below.




(i) At what time was the demand for electricity smallest? ..... [1]

(ii) Write down the maximum power used in Britain during the day.

..... MW [1]

(iii) In the early hours of the morning, demand for electricity is low. Name **one** type of power station that is not supplying electricity to the distribution system at this time.

..... [1]

(iv) At 20:00, Britain transferred **in** 400 MW of electricity from Ireland, 1 000 MW from France and 1 000 MW from the Netherlands to cope with demand. Calculate how much electrical power was being produced in Britain at this time. Give the correct unit. [3]

Power = ..... Unit = .....



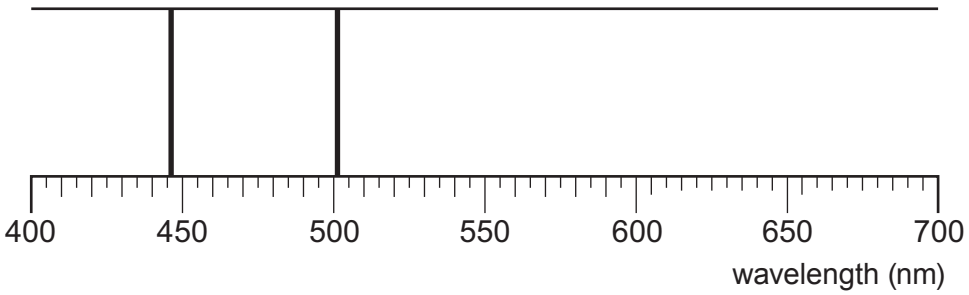




**Turn over.**

Examiner only

**5.** The diagram shows two of the dark lines in the spectrum from the Sun.




(i) Use the information in the table below to put a tick (✓) alongside the element that produced this pair of dark lines. [1]

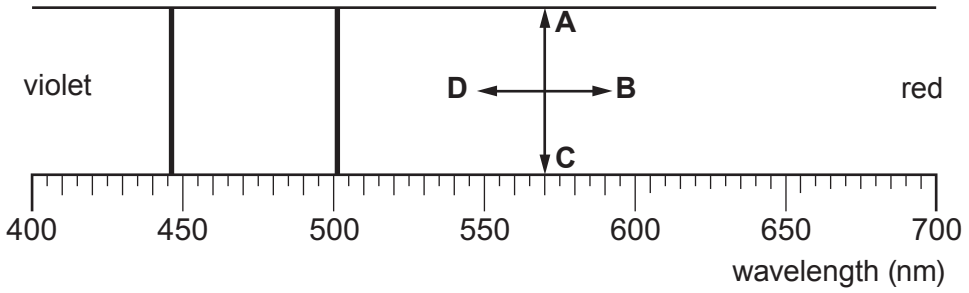
| Element | Some wavelengths in the spectrum (nm) | | Gas used to make the spectrum (Tick ✓) |
|---|---|---|---|
| Iron | 431 | 527 | |
| Hydrogen | 410 | 486 | |
| Helium | 447 | 502 | |
| Sodium | 590 | 591 | |

(ii) Underline the word or phrase in the bracket to correctly complete the following sentence. [1]

The two dark lines are due to light being
(**absorbed** / **reflected** / **not absorbed** / **combined**) by the atoms.

(iii) These two dark lines show up in the spectrum of light from distant galaxies, but their positions are different. Write down one of the letters **A, B, C** or **D** which shows the direction that the lines would move in the diagram below.

..... [1]



Examiner only

(iv) State **why** these lines have moved in the direction you have chosen. [1]

.....

.....

.....

(v) State what this evidence from distant galaxies tells us about the Universe. [1]

.....

(vi) Name the event that the evidence suggests created our Universe. [1]

.....

6





**Turn over.**

Examiner only

**6.** There is an increasing demand for electricity but the reserves of fossil fuels are decreasing.

*(a)* A way to meet increasing demand for electricity is to build nuclear power stations.

(i) Give **two** reasons to support building more nuclear power stations than other types in the future. [2]

1. .....

2. .....

(ii) Nuclear waste is a problem that must be dealt with. One possible solution would be to bury the waste deep underground. State **one** disadvantage of burying nuclear waste. [1]

.....

*(b)* Electricity can also be generated using bio-fuels such as woodchip and straw. Plants for bio-fuels use carbon dioxide from the air as they grow. Explain why burning bio-fuels is more environmentally friendly than burning fossil fuels. [2]

.....

.....

.....

*(c)* The table below shows typical crop yields and the energy content of some bio-fuels.

| Crop | Crop yield in a year from each $km^2$ of land (tonnes) | Energy content (units/tonne) |
|---|---|---|
| poplar | 8 | 18 |
| willow | 10 | 20 |
| grass | 5 | 16 |

(i) Which crop would be the worst choice for using as a bio-fuel? ..... [1]

Give **two** reasons for your answer. [2]

1. .....

2. .....

Examiner only

(ii) A 10 MW power station needs 50 000 tonnes of willow crop a year.

I. Calculate the area of land needed to grow this amount of willow crop. [1]

Area ..... $km^2$

II. Calculate the energy content of 50 000 tonnes of willow crop. [1]

Energy content = ..... units

(iii) An area of 2 $km^2$ of land is needed to produce 10 MW using wind turbines. Explain why this method of generating electricity is more environmentally friendly than using bio-fuels. [2]

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12





**Turn over.**

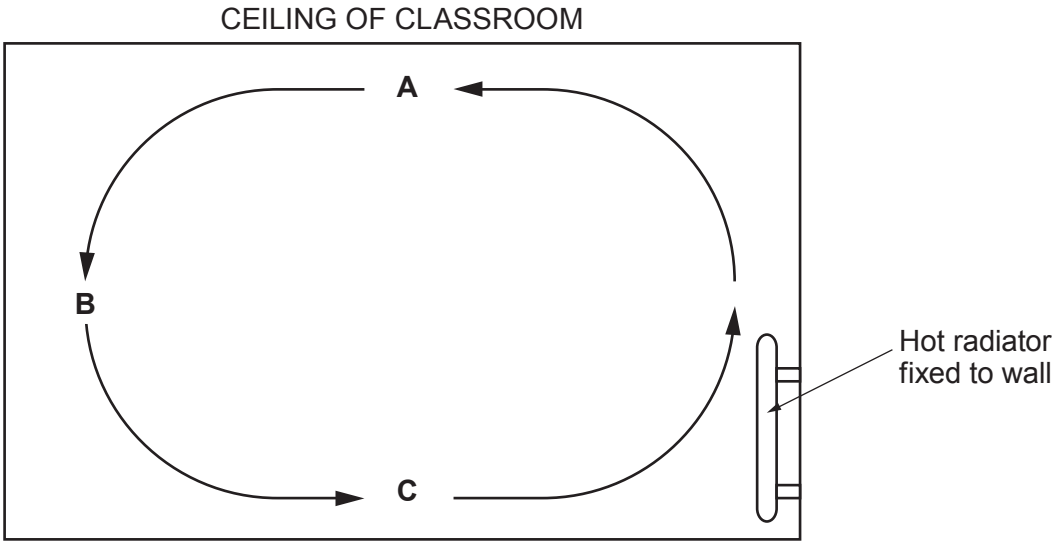
Examiner only

**7.** *(a)* A classroom has a volume of 80 $m^3$ and contains 104 kg of air. Use an equation from page 2 to calculate the density of the air in the room and state the unit. [3]

Density = .....

Unit .....

*(b)* The classroom is now heated by a radiator. This sets up a convection current in the air as shown in the diagram below.




(i) At which point **A, B** or **C** is the air in the classroom the hottest? ..... [1]

(ii) At which point **A, B** or **C** is the air in the classroom least dense? ..... [1]

(iii) Give a reason for your answer to *(b)*(ii). [1]

.....

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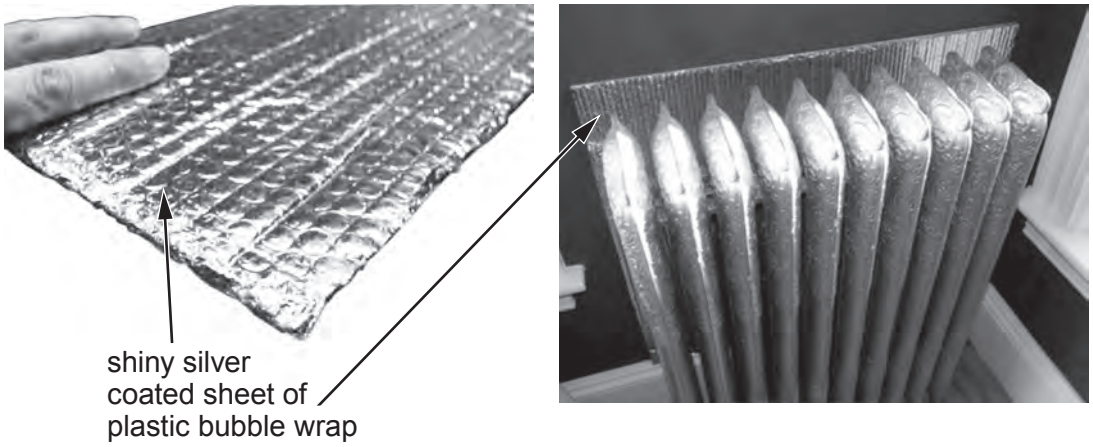
Examiner only

*(c)* A shiny silver coated sheet of plastic bubble wrap is placed on the wall behind the radiator. Explain how this can reduce heat loss from the classroom by conduction, convection and radiation. [6 QWC]

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**END OF PAPER**