



General Certificate of Secondary Education  
2022

Centre Number

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Candidate Number

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# Physics

Unit 1

Foundation Tier



[GPY11]

\*GPY11\*

**TUESDAY 7 JUNE, MORNING**

## TIME

1 hour 15 minutes.

## INSTRUCTIONS TO CANDIDATES

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

**You must answer the questions in the spaces provided.**

**Do not write outside the boxed area on each page or on blank pages.**

Complete in black ink only. **Do not write with a gel pen.**

Answer **all** questions.

## INFORMATION FOR CANDIDATES

The total mark for this paper is 80.

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 **2(e)**.



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\*28GPY1102\*



1 (a) An athlete runs a 400 m race in a time of 50 seconds.



Source: © Getty Images

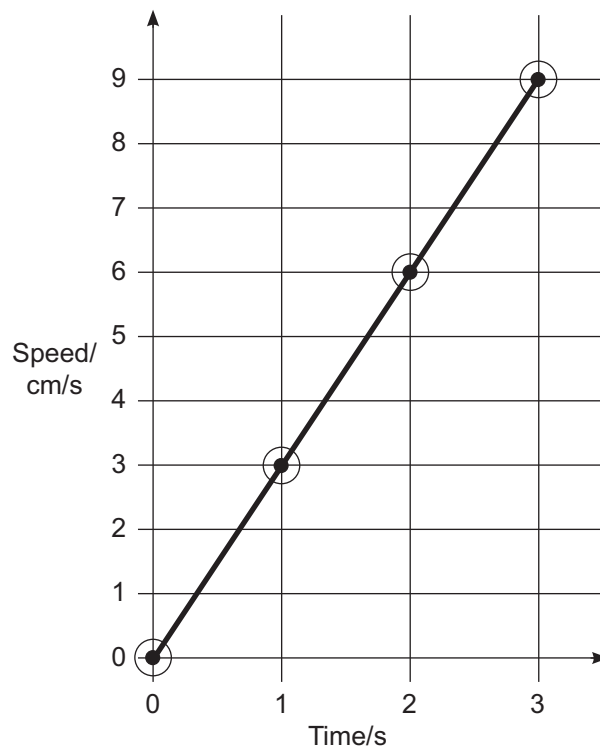
Calculate the average speed of the athlete.  
**Show clearly how you get your answer, starting with the equation you plan to use.**

Average speed = \_\_\_\_\_ m/s [3]

[Turn over



- (b) As a marble rolls down a slope, its speed increases.  
The speed–time graph for the marble is shown below.



Source: Chief Examiner

- (i) Calculate the distance travelled by the marble down the slope.  
**Show clearly how you get your answer.**

Distance = \_\_\_\_\_ cm [3]



- (ii) Calculate the rate of change of speed of the marble as it travels down the slope.  
**Show clearly how you get your answer, starting with the equation you plan to use.**

Rate of change of speed = \_\_\_\_\_ cm/s<sup>2</sup> [3]



(c) (i) State the Principle of Moments.

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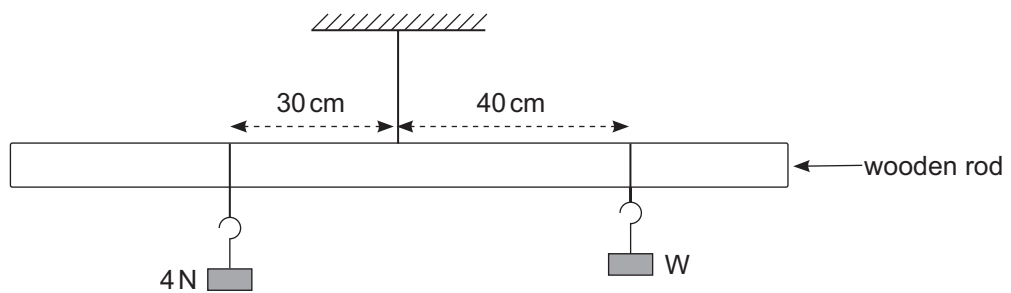
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[3]

A wooden rod is pivoted at its centre.

A weight  $W$  is placed as shown.

The rod is in equilibrium when a force of 4 N is placed as shown.



Source: Chief Examiner

(ii) Calculate the weight  $W$ .  
Show clearly how you get your answer.

$W = \underline{\hspace{2cm}} \text{ N [3]}$



(iii) The weight  $W$  is moved towards the centre of the wooden rod.  
In which direction should the 4 N weight be moved so that the rod is again in equilibrium?

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

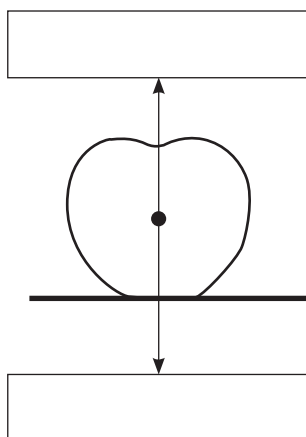
(d) Explain, in terms of pressure, why a sharp knife makes cutting a material easier.

\_\_\_\_\_  
\_\_\_\_\_ [2]

[Turn over



- 2 (a) The diagram shows an apple at rest sitting on a level surface.



Source: Chief Examiner

The apple has two forces acting on it.  
Write the name of each force in the appropriate box.

What can you say about the size of the two forces?

[3]

- (b) The diagram shows a cyclist **moving** along a level road.  
The two horizontal forces acting are shown.



Source: Getty Images Plus 1072556762

- (i) Describe the motion of the cyclist.

[1]





At another time the two forces acting on the cyclist have changed, as shown below.



Source: © Getty Images

(ii) Calculate the resultant of these two forces and state its direction.

Resultant force = \_\_\_\_\_ N

Direction = \_\_\_\_\_ [2]



- (c) The diagram shows the **resultant** force acting on a car.  
The car has a mass of 2 000 kg.



Source: © Getty Images

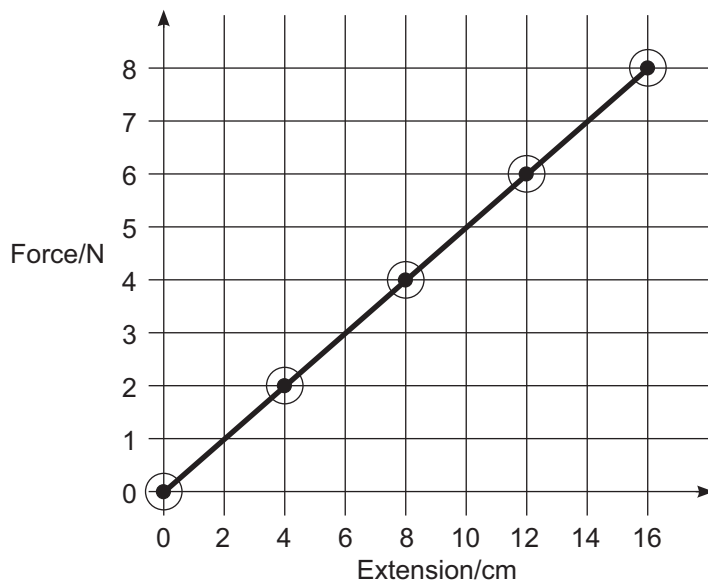
Calculate the acceleration of the car.

**Show clearly how you get your answer, starting with the equation you plan to use.**

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



(d) During an experiment to investigate the stretching of a spring the graph below was obtained.



Source: Chief Examiner

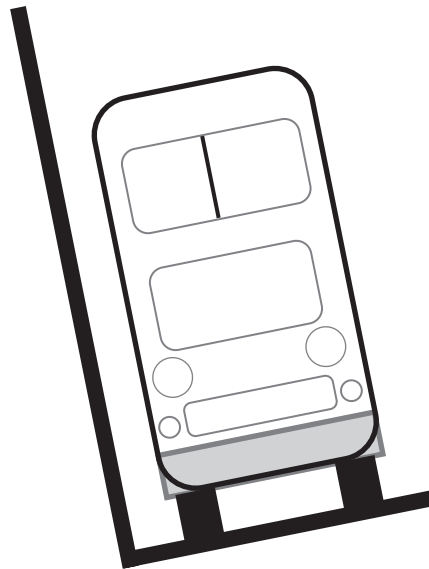
Using the graph, determine the spring constant of the spring.  
Show clearly how you get your answer.

Spring constant = \_\_\_\_\_

Unit = \_\_\_\_\_ [4]



- (e) The diagram shows a double-decker bus undergoing a tilt test. The centre of gravity is an important concept when dealing with the stability of an object such as a double-decker bus.



Source: Chief Examiner

Describe the role the centre of gravity and other factors play in the stability of the double-decker bus.

In your answer you should state:

- the meaning of centre of gravity;
- how the position of the centre of gravity affects stability;
- another factor affecting stability;
- why standing on the upper deck of such a bus is not allowed;
- what causes the bus to fall over if it is tilted beyond a certain angle.

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

Write your answers on the opposite page.





Centre of gravity \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Centre of gravity and stability \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Other factor affecting stability \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Standing on the upper deck \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Cause of bus falling over \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

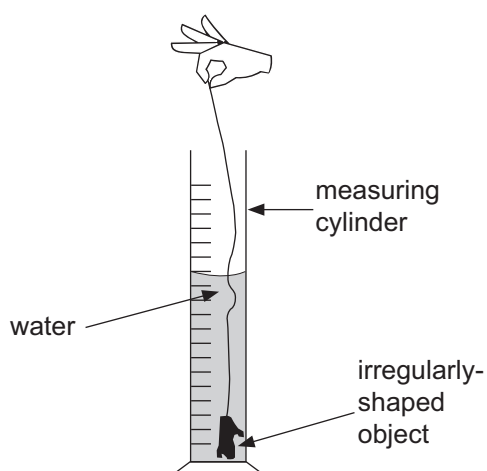
\_\_\_\_\_

[6]

[Turn over



- 3 (a) An experiment is carried out to find the density of a metal. The metal is in the form of an irregularly-shaped object.



Source: Chief Examiner

The measuring cylinder initially contained  $220 \text{ cm}^3$  of water. When the object is placed in the measuring cylinder the water level rises to  $235 \text{ cm}^3$ .

The irregularly-shaped object has a mass of 120 g. Calculate the density of the metal and state its unit.

**Show clearly how you get your answer, starting with the equation you plan to use.**

Density = \_\_\_\_\_

Unit = \_\_\_\_\_ [5]



- (b) (i) The kinetic theory describes matter as a large number of particles. The following statements are about the particles that are found in solids, liquids and gases.

In each box state whether the statement relates to the particles in a solid, a liquid or a gas.

Statement	Solid, Liquid or Gas
The particles have large gaps between them and are entirely free to move.	
The particles are mainly touching but have small gaps between them.	
The particles have strong forces between them.	

[3]

- (ii) The kinetic theory can also be used to describe how heat is conducted by a metal. Name the particle that plays a major role in the conduction of heat by a **metal** and how the heat energy is transferred.

Particle = \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_ [2]

[Turn over



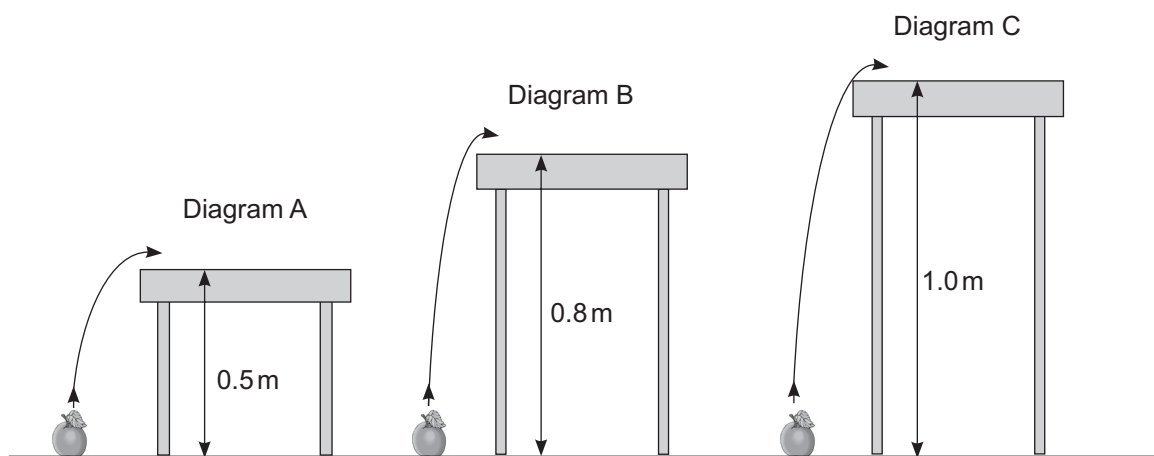
4 Energy can exist in many forms.

(a) From the list below, circle the **two** words which are **not** forms of energy.

Heat      Mass      Strain      Power      Sound      Kinetic

[2]

(b) An apple weighs 1 N. The apple is lifted from the floor and placed on a table.



Source: Principal Examiner

Which one of the actions, shown in the diagrams, A, B or C, would need 1 J of work?

Diagram = \_\_\_\_\_

Write down the equation that could be used to check your answer.

\_\_\_\_\_ [2]





(c) (i) State the Principle of Conservation of Energy.

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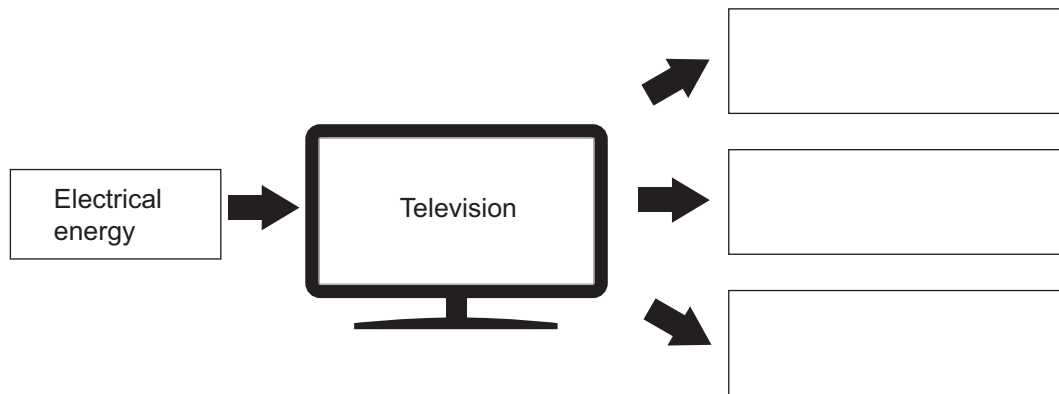
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[2]

(ii) Televisions use electrical energy.

In the diagram below, insert the names of the output energies in the boxes provided.



Source: Chief Examiner

Which of the output forms of energy you have named is **not** useful in a television?

Energy form \_\_\_\_\_ [4]



(iii) The television has an efficiency of 0.75.

The input electrical energy is 200 J.

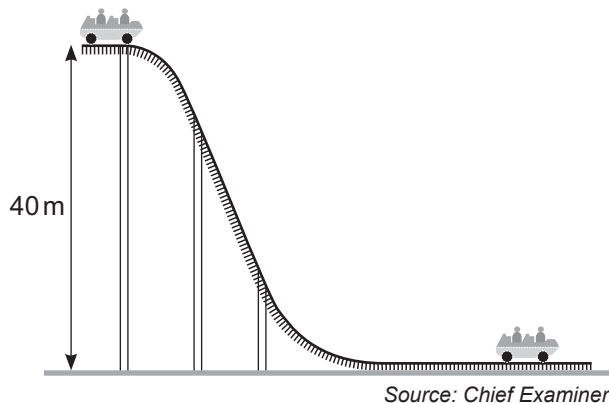
Calculate the useful output energy.

**Show clearly how you get your answer, starting with the equation you plan to use.**

Useful energy = \_\_\_\_\_ J [3]



- (d) A car of mass 200 kg is at the top of a roller coaster, as shown in the diagram below.



- (i) Calculate the potential energy of the car at the top of the roller coaster. **Show clearly how you get your answer, starting with the equation you plan to use.**

Potential energy = \_\_\_\_\_ J [3]

- (ii) At the bottom of the roller coaster the speed of the car is 20 m/s. Calculate its kinetic energy. **Show clearly how you get your answer, starting with the equation you plan to use.**

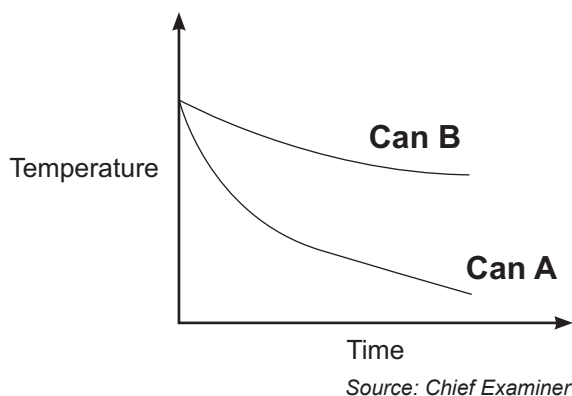
Kinetic energy = \_\_\_\_\_ J [3]

[Turn over



- (e) Two metal cans, **A and B**, of equal dimensions are made of the same material. However, one can is painted silver the other can is painted matt black. Both were filled at the same time with very hot water.

The temperature of each can was measured over a period of several minutes and the temperature–time graphs obtained as each can cools are shown below.



Which can cools faster?  
Why does this can cool faster?

Can \_\_\_\_\_

Reason \_\_\_\_\_

[2]





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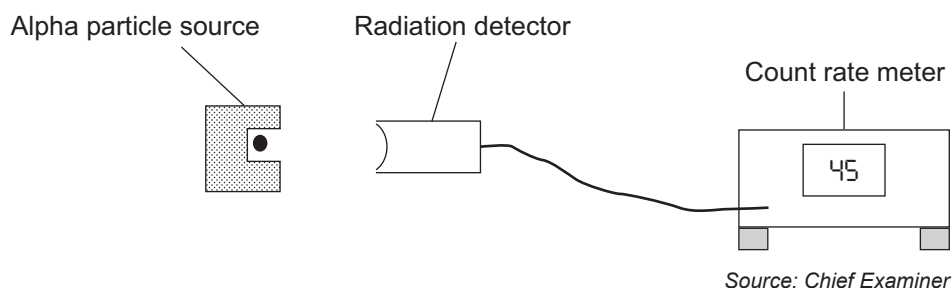
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- 5 (a) Atoms are composed of three types of particle.  
Complete the table below by filling in the blank boxes.  
Some have already been done for you.

Name of particle	Position in atom	Relative electrical charge	Relative mass
<i>proton</i>	<i>In the nucleus</i>	<b>+ 1</b>	<b>1</b>
<i>neutron</i>			
			$\frac{1}{1836}$

[3]

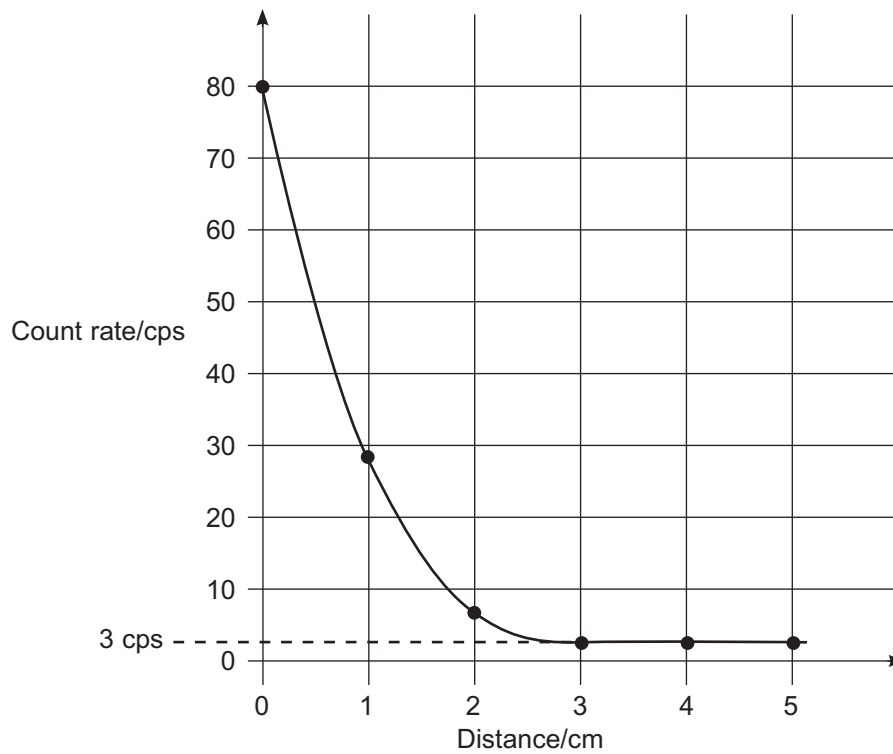
- (b) The range of alpha ( $\alpha$ ) particles in air may be investigated using the equipment shown below.



The distance between the alpha source and the radiation detector is changed.  
The reading on the count rate meter is noted in counts per second (cps) for each distance.

A graph of the count rate against the distance was plotted as shown opposite.





Source: Chief Examiner

You will notice that the graph never shows a reading of less than 3 cps.

(i) What name is given to this constant reading?

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

(ii) What is the source of this constant reading?

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

(iii) Using the graph, estimate the range of the alpha particles in air.

Range = 0 cm to \_\_\_\_\_ cm [1]

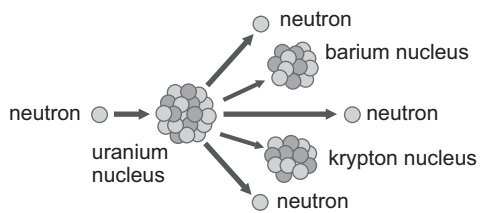
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(c) Working with radioactive sources in the lab can present danger.  
Name two precautions that you would recommend.

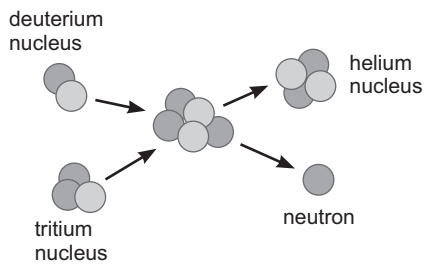
1. \_\_\_\_\_
2. \_\_\_\_\_ [2]

(d) Two nuclear processes release large amounts of energy.  
These two processes are shown in the diagrams below.  
For each diagram name the nuclear process shown and where it acts as a source of energy.



Name of nuclear process \_\_\_\_\_

Where it is a source of energy \_\_\_\_\_



Source: Chief Examiner

Name of nuclear process \_\_\_\_\_

Where it is a source of energy \_\_\_\_\_

[4]







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<b>Question Number</b>	<b>Marks</b>
1	
2	
3	
4	
5	

<b>Total Marks</b>	
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**Examiner Number**

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