Write your name here

Surname	Other names

Edexcel GCSE

Centre Number	Candidate Number

Physics/Science

Unit P1: Universal Physics

Higher Tier

Additional Sample Assessment Material
Time: 1 hour

Paper Reference
5PH1H/01

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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FORMULAE

You may find the following formulae useful

wave speed = frequency × wavelength $v = f \times \lambda$

$$\text{wave speed} = \frac{\text{distance}}{\text{time}} \qquad v = \frac{x}{t}$$

electrical power = current × potential difference $P = I \times V$

cost of electricity = power × time × cost of 1 kilowatt-hour

$$\text{power} = \frac{\text{energy used}}{\text{time taken}} \qquad P = \frac{E}{t}$$

$$\text{efficiency} = \frac{\text{(useful energy transferred by the device)}}{\text{(total energy supplied to the device)}} \times 100\,\%$$

$$\frac{\text{primary voltage}}{\text{secondary voltage}} = \frac{\text{number of turns on primary coil}}{\text{number of turns on secondary coil}} \qquad \frac{V_p}{V_s} = \frac{N_p}{N_s}$$

Answer ALL questions

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Using energy

1 The photograph shows a treadmill in a gym.
The display on the treadmill indicates how much energy the boy is 'burning'.

(a) The boy is running on a horizontal surface.

Which of these energy transfers best describes the energy 'burn'?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** chemical energy to electrical energy

☒ **B** chemical energy to kinetic energy

☒ **C** electrical energy to chemical energy

☒ **D** electrical energy to gravitational potential energy

(b) The rollers on the treadmill are powered by an electric motor.
The motor is connected to a 230 V mains supply.
The current in the motor is 3.50 A.

Show that the power input to the motor is about 800 W.

(2)

(c) Not all of the 800 W is used to turn the rollers.
150 W is wasted.

(i) Calculate the power used to turn the rollers.

(1)

power = ... W

(ii) Calculate the efficiency of the motor.

(2)

efficiency = ...

(d) Most of the wasted power is thermal.
The motor runs at a steady speed.
The motor begins to warm up.

Explain what happens to the temperature of the motor as the motor continues to run.

(2)

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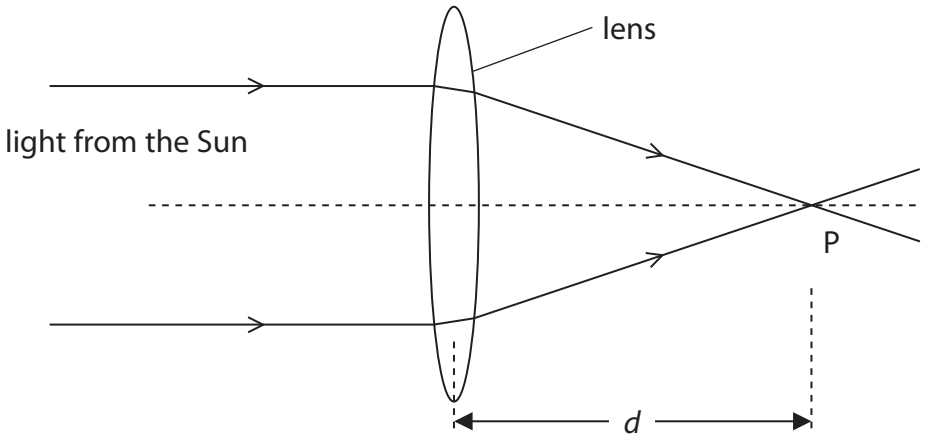
(Total for Question 1 = 8 marks)

Using the Sun

2 (a) A student uses a converging lens to make an image of the Sun.



(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

The lens forms a real image of the Sun at P, where the light rays cross.

The distance *d* is the

(1)

☒ **A** focal point

☒ **B** focal length

☒ **C** object length

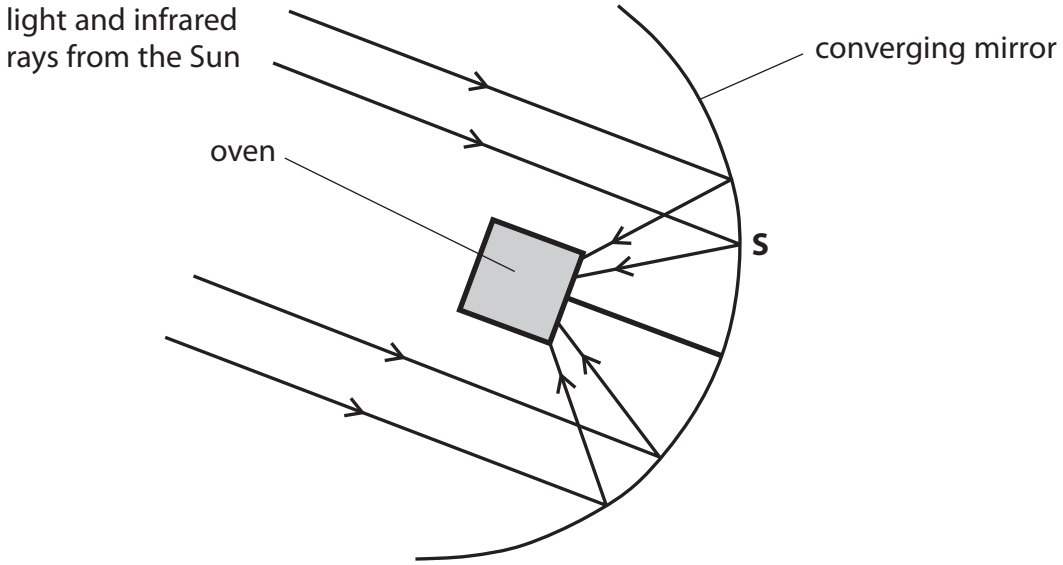
☒ **D** object distance

(ii) Radiation from the Sun includes some infrared waves.
The lens bends infrared waves less than it does ordinary light.

Label, with an **R**, a place on the diagram where the infrared rays could cross.

(1)

(b) In some countries, infrared rays from the Sun are used to cook food.
Light and infrared rays are both focused using a converging mirror.



(i) Which of the following is transferred by the waves from the Sun to the food?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** information

☒ **B** matter

☒ **C** sound energy

☒ **D** thermal energy

(ii) State what happens to the rays at **S**.

(1)

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(iii) Explain why the light rays and infrared rays converge towards the same point.

(2)

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(iv) The infrared waves travel at a speed of 300 000 km/s.
They take 500 s to travel from the Sun to the Earth.

Calculate the distance between the Earth and the Sun.

(3)

distance = ... km

(Total for Question 2 = 9 marks)

Using microwaves

3 (a) Complete the sentences by putting a cross (☒) in the box next to your answer.

(i) All electromagnetic waves have the same

(1)

☒ **A** amplitude in a vacuum

☒ **B** frequency in air

☒ **C** speed in a vacuum

☒ **D** wavelength in air

(ii) In the electromagnetic spectrum, microwaves are between

(1)

☒ **A** radio waves and infrared waves

☒ **B** ultraviolet waves and x-rays

☒ **C** visible light and ultraviolet waves

☒ **D** x-rays and gamma rays

(b) The microwave spectrum is divided into bands.

	Bands in the microwave spectrum								
name of band	X	K	Q	U	V	E	W	F	D
width of band / GHz	8 – 12	12 – 40	33 – 50	40 – 50	50 – 75	60 – 90	75 –110	90 – 140	110 –170

(i) State what **Hz** means.

(1)

.....

.....

(ii) Which band in the microwave spectrum has the shortest wavelength?

(1)

.....

(iii) Microwaves can be used for satellite communications.
State another use for microwaves.

(1)

.....

.....

(iv) Microwaves in the E band can be absorbed by oxygen, carbon dioxide and nitrogen.

Explain why microwaves in the E band are **not** suitable for use in satellite communications.

(2)

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(v) Describe how the highlighted bands, Q, E and F, differ from the other bands in the microwave spectrum.

(2)

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(Total for Question 3 = 9 marks)

Low frequency waves

4 (a) Infrasound is a low frequency sound wave.

Which of the following could be a use for infrasound?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** cleaning golf clubs

☒ **B** communication between animals

☒ **C** measuring the depth of the ocean

☒ **D** scanning unborn babies

(b) Seismic waves are low frequency waves.
Seismic waves are produced by an earthquake.

(i) Describe how an earthquake happens.

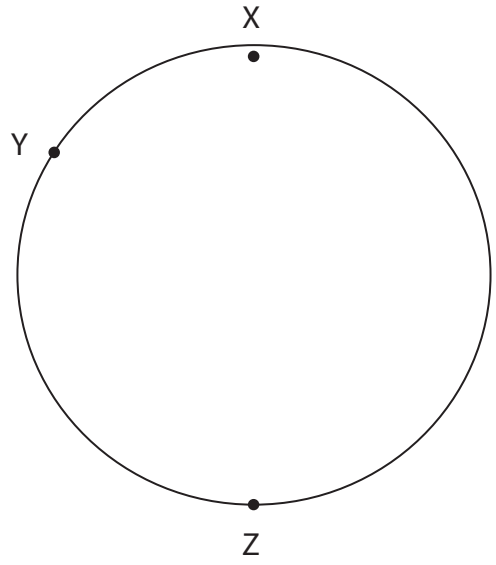
(3)

(ii) P and S are two types of seismic wave.
P waves travel faster than S waves.

Give **one** other difference between P waves and S waves.

(1)

(c) The diagram shows a section through the Earth with an earthquake happening at X.



P waves and S waves are produced at X and travel in curved paths.
P waves and S waves can be detected at Y.

(i) Give the name of the effect which causes the waves to travel along curved paths.

(1)

.....

(ii) Explain why this effect occurs.

(2)

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(iii) P waves from X can be detected at Z.
S waves from X cannot be detected at Z.

Explain what information this gives about the Earth's structure.

(2)

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(Total for Question 4 = 10 marks)

Generating electricity

5 The photographs show two different methods of generating electricity.
Photograph A shows a wind-powered generator on the roof of a house.
Photograph B shows the inside of an oil-fired power station which is connected to the National Grid.

photograph A

photograph B

(a) The table shows some information about the wind-powered generator.

cost (including installation)	£2500
electrical energy produced in one year	900 kWh

Electricity from the National Grid costs 15 p per kWh.

Calculate the payback time for the wind-powered generator.

(3)

payback time = ... years

(b) Transformers are used on a small scale in the home and on a large scale in the National Grid.

(i) The transformer for an electric toothbrush charger steps down the mains voltage to 9.0 V.
The mains voltage is 230 V.
The transformer has 690 turns on its primary coil.
Calculate the number of turns on the secondary coil.

(3)

number of turns = ...

*(ii) The National Grid transmits electricity around the country.
Explain how using transformers makes the transmission of electrical energy more efficient.

(6)

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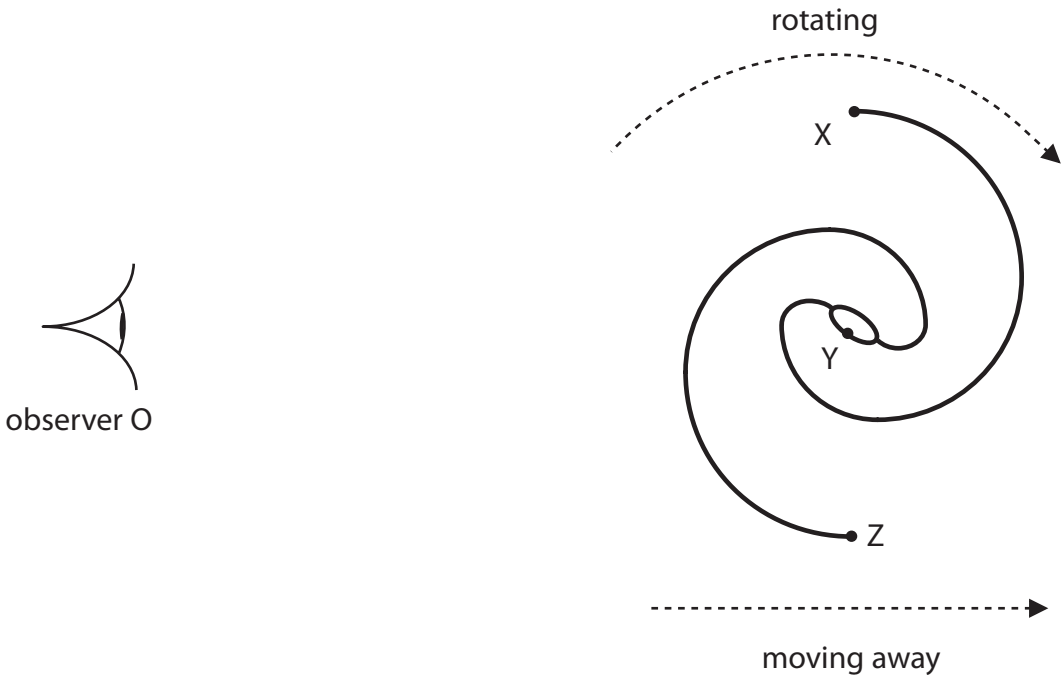
(Total for Question 5 = 12 marks)

Studying stars

6 (a) The diagram shows a spiral galaxy and an observer, O.
The spiral galaxy is rotating as well as moving away from O.
The diagram is not drawn to scale.



(i) Light from three stars, X, Y and Z, reaches O.
The light from star Y shows red shift.

Explain why the light received from star Y shows red shift.

(2)

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.....

(ii) The light received from each of the three stars, X, Y and Z, shows different amounts of red shift.

Explain these differences.

(4)

*(b) Compare and contrast the future evolution of our Sun with that of a star with a much larger mass.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Additional Sample Mark Scheme
GCSE Science 2011

GCSE

GCSE Physics (5PH1H/01)

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- For questions worth more than one mark, the answer column shows how partial credit can be allocated. This has been done by the inclusion of part marks eg (1).
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- Write legibly, with accurate spelling, grammar and punctuation in order to make the meaning clear
- Select and use a form and style of writing appropriate to purpose and to complex subject matter
- Organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities.

Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

General Information

The following symbols are used in the mark schemes for all questions:

Symbol	Meaning of symbol
eq	Indicates that credit should be given for other correct alternatives to a word or statement
/ oblique	Words or phrases separated by an oblique are alternatives to each other
{ } curly brackets	Indicate the beginning and end of a list of alternatives (separated by obliques) where necessary to avoid confusion
( ) round brackets	Words inside round brackets are to aid understanding of the marking point but are not required to award the point

Question Number	Answer	Acceptable answers	Mark
1(a)	B		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)	substitution (1) 230×3.5 evaluation (1) 805 (= about 800 W)	calculation can be worked in reverse e.g. 800 ÷ 3.5 (1) 228 (= about 230 V) (1) give full marks for correct answer, no working	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(c)(i)	(useful power =) 650 (W)	655 (W)	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(c)(ii)	substitution (1) (efficiency =) $\frac{650 \times 100}{800}$ evaluation (1) 81%	ecf from 1(c)(i) 0.81 give full marks for correct answer, no working	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(d)	An explanation linking the following points • the motor reaches a constant temperature (1) • (equilibrium reached) when the power lost equals the power supplied (1)	 when the energy lost equals the energy supplied	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(a)(i)	B		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(a)(ii)	R marked on the axis to the right of P		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)(i)	D		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)(ii)	reflected		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)(iii)	An explanation linking the following points • laws of reflection / equal angles (1) • same for <u>both</u> types of wave (1)		**(2)**

Question Number	Answer	Acceptable answers	Mark
2(b)(iv)	substitution (1) $300\,000 = \frac{d}{500}$ transformation (1) (distance =) $300\,000 \times 500$ evaluation (1) 150 000 000 (km)	**<u>Accept</u>** either order for transformation / substitution give 3 marks for correct answer, no working	**(3)**

Question Number	Answer	Acceptable answers	Mark
3(a)(i)	C		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(a)(ii)	A		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)(i)	hertz / 1 cycle per second / s^{-1}	frequency unit	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)(ii)	D	110-170 / band with the highest frequency	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)(iii)	cooking	monitoring the weather / mobile phones	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)(iv)	An explanation linking the following points • atmosphere contains oxygen / carbon dioxide / nitrogen (1) • so waves would be absorbed in the atmosphere (1)	waves would not reach the satellite	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(b)(v)	A description including the following points in a logical order • the other bands form a continuous sequence / eq (1) • but Q, E and F each overlap two other bands / eq (1)		**(2)**

Question Number	Answer	Acceptable answers	Mark
4(a)	B		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)(i)	A description including the following points • plates in Earth's crust (1) • relative movement between plates (1) • slippage at a plate boundary (1)		**(3)**

Question Number	Answer	Acceptable answers	Mark
4(b)(ii)	P waves are longitudinal and S waves are transverse	S waves do not travel through liquids	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(c)(i)	refraction		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(c)(ii)	An explanation linking the following points • wave speed changes (1) • because (nature of) rock changes	change of direction because {density / type / composition / state} of rock changes	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(c)(iii)	An explanation linking the following points • S waves cannot travel through liquid (1) • so (outer) core is liquid (1)	**Allow** transverse waves for S waves	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(a)	substitutions (2) (saving per year =) 900 × 0.15 (payback time =) 2500/135 evaluation (1) 18.5 (years)	£135 give 3marks for correct answer, no working	**(3)**

Question Number	Answer	Acceptable answers	Mark
5(b)(i)	substitution (1) $\frac{230}{9} = \frac{690}{N}$ transformation (1) $N = \frac{690 \times 9}{230}$ evaluation (1) 27	**Accept** either order for transformation / substitution give 2 marks for correct answer, no working	**(3)**

Question Number		Indicative content	Mark
QWC	*5(b)(ii)	**Basic ideas** • transformers change voltage and/or current • transformers use a.c. • the current warms the transmission wires • step-up transformers increase the voltage • step-up transformers decrease the current • energy is wasted **Linked** • power depends on both current and voltage • power = current × voltage ($P = I \times V$) • at high voltage, the same power needs less current • correct mention of turns ratio related to voltage change • a smaller current in a wire produces less heat **Including reasons** • when you use a higher voltage, the current is lower. With lower current, the amount of heat produced is less. If less heat is lost, the efficiency is greater. • correct use of ($P = I \times V$) to show that current is less in the transmission wires. Less heat is lost because the current is lower. If less heat is lost, the efficiency is greater. • current wastes heat in wires. Using a higher transmision voltage, and therefore a lower current, saves more energy in the transmission wire than is lost in the transformers	**(6)**
Level	**0**	no rewardable material	
1	**1-2**	• basic relevant ideas, not linked and no explanation or reason • e.g. the current warms the transmission wires • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3-4**	• detailed comments linking ideas • e.g. a smaller current in a wire produces less heat • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• full explanation with reasons • e.g. transformers are used to reduce the current so that the heat loss is less and efficiency is more • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Question Number	Answer	Acceptable answers	Mark
6(a)(i)	An explanation linking the following points • star moving away • so wavelength (appears) longer	frequency (appears) lower	**(2)**

Question Number	Answer	Acceptable answers	Mark
6(a)(ii)	An explanation linking the following points • idea of speed differences (1) • correct detail of speed differences (1) • relating (the amount of) red shift to (relative) speed (1) • correct detail of relationship e.g. greater speed means greater red shift (1)	e.g. $v_X > v_Y$ $v_Y > v_Z$	**(4)**

Question Number		Indicative content	Mark
QWC	***6(b)**	A comparison including some of the following points **Some relevant stages** • main sequence • red giant • white dwarf • black dwarf • red supergiant • supernova • neutron star • black hole **Detailed comments linked** • larger mass star leads to red super giant • the Sun will not become a supernova • big stars end up as black holes • both stars become giants • the most massive stars turn into a black hole **Accurate comparisons and contrasts** • gravity affects larger mass stars more • smaller mass stars live longer • gravity causes collapse of stars of any mass • for a black hole the gravity is so big that no light escapes	**(6)**
Level	**0**	no rewardable material	
1	**1-2**	• some basic relevant stages mentioned, no comparisons or contrasts • no reasons for sequence • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3-4**	• detailed comments linked • e.g. relevance of mass to different stages, either comparisons or contrasts • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• accurate comparisons and contrasts • e.g. including the relevance of mass and gravitation to the different sequences • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	