Write your name here

Surname	Other names

Edexcel GCSE

Centre Number	Candidate Number

Physics/Science

Unit P1: Universal Physics

Higher Tier

Sample Assessment Material
Time: 1 hour

Paper Reference
5PH1H/01

You do not need any other materials.

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

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

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

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 ☒.

Refracting telescope

1 The photograph shows the refracting telescope used by Galileo to observe the planets.

Gianni Tortoli/Science Photo Library

(a) (i) Galileo used his telescope to observe the visible light from planets.

State **two** other examples of telescopes that are used to observe planets or stars.

(2)

1 .....

.....

2 .....

.....

(ii) When a ray of light enters a glass block, the ray refracts.

What does **refracts** mean?

(1)

.....

.....

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

A converging lens refracts light to produce an image of a distant object on a screen. The image on the screen is

(1)

☒ **A** magnified

☒ **B** virtual

☒ **C** upside down

☒ **D** the right way up

(c) More recent telescopes use two converging lenses, as shown in the photograph.

© Tasco telescopes

Lens A produces a real image of the planet.

Describe the purpose of lens B.

(2)

.....

.....

.....

.....

(d) Galileo used his telescope to observe the planet Jupiter and its moons.

Explain why Galileo's observations contradicted the scientific ideas about the solar system that were most popular at that time.

(2)

.....

.....

.....

.....

(Total for Question 1 = 8 marks)

Generating electricity

2 The lights on a bicycle can be powered by a battery or a dynamo.

(a)

power = voltage × current

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

Power can be defined as

(1)

- ☒ **A** current per second
- ☒ **B** energy per second
- ☒ **C** frequency per second
- ☒ **D** voltage per second

(ii) The 9 V battery in a bicycle light produces a current of 0.35 A.

Calculate the power supplied to the light by the battery.

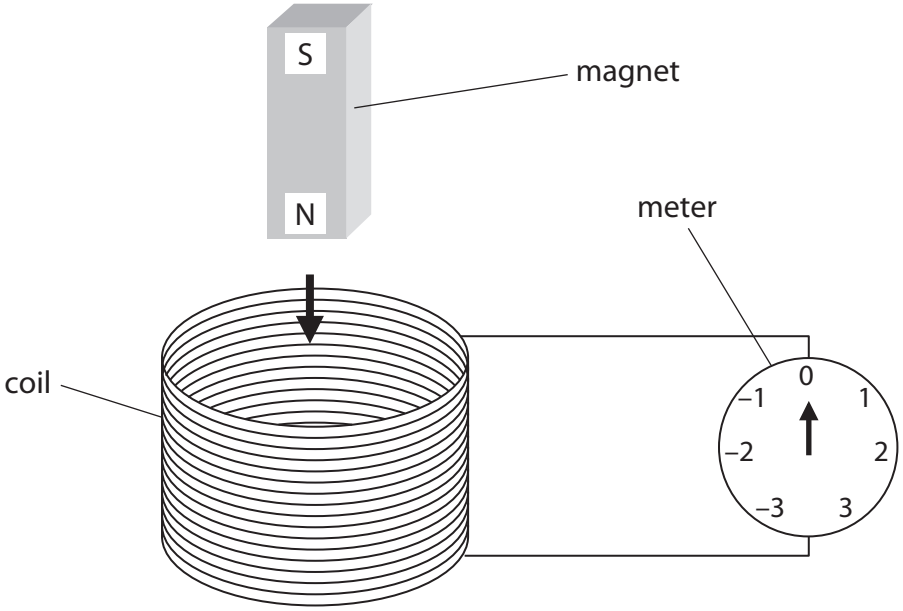
(2)

power = ... W

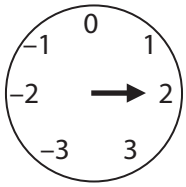
(b) When this bicycle wheel turns the dynamo, it generates electricity.

A dynamo contains a magnet moving near a coil of wire.

The diagram below shows a magnet moving near a coil.

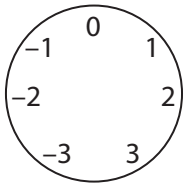


When the magnet is just entering the coil the pointer on the meter points to the number 2 as shown.



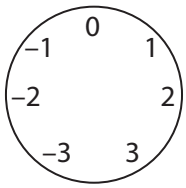
(i) The magnet stops moving and remains inside the coil.
Draw an arrow on the meter below to show the position of the pointer now.

(1)

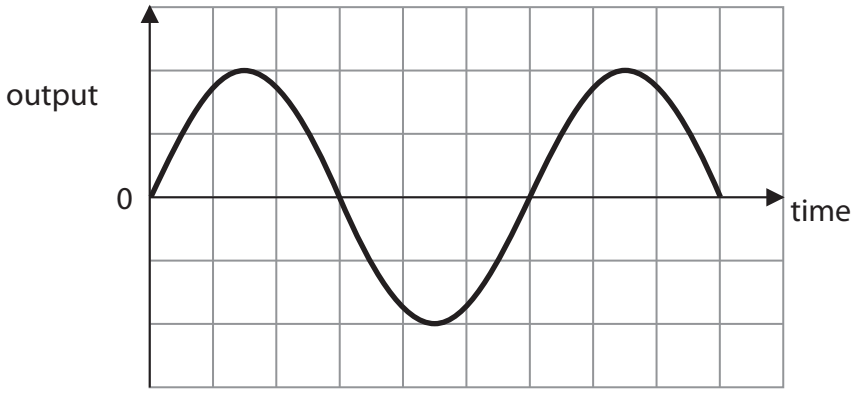


(ii) The magnet now moves out of the coil at the same speed as before.
Draw an arrow on the meter below to show the position of the pointer just as the magnet leaves the coil.

(1)



(c) A dynamo on a bicycle is connected to a data logger.
The data logger is connected to a computer.
The wheel on the bicycle turns at a steady speed.
The computer screen displays the following graph.



(i) The wheel on the bicycle now turns faster.

On the same axes, draw the graph of output against time at this new speed.

(2)

(ii) What evidence does the graph provide to show that the output is alternating?

(1)

.....

.....

.....

(Total for Question 2 = 8 marks)

Using electromagnetic waves

3 Radio waves and microwaves are part of the electromagnetic spectrum.

(a) Which of these statements is true for radio waves?

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

(1)

☒ **A** radio waves have low frequency and short wavelength

☒ **B** radio waves have low frequency and long wavelength

☒ **C** radio waves have high frequency and short wavelength

☒ **D** radio waves have high frequency and long wavelength

(b) Explain why there is a time delay in receiving radio transmissions in the UK from Australia.

(2)

.....

.....

.....

.....

(c)

wave speed = frequency × wavelength

The speed of all electromagnetic waves in a vacuum is 3.0×10^8 m/s.
The wavelength of the microwaves used by mobile phones is 34 cm.

Calculate the frequency of these microwaves.
Show your working and give the unit.

(4)

frequency = ... unit .....

(d) 'Mobile phones do not use ionising radiation so they are completely safe.'

Discuss the accuracy of this statement about safety.

(3)

(Total for Question 3 = 10 marks)

Earthquakes

4 (a) The outside layer of the Earth is made up of tectonic plates. These plates are moving very slowly.

(i) Explain what causes the plates to move.

(2)

.....

.....

.....

.....

(ii) Describe **one** way an earthquake can be caused.

(2)

.....

.....

.....

.....

(b) An earthquake sends seismic waves through the Earth.

- P-waves and S-waves are seismic waves.
- P-waves travel faster than S-waves.

(i) Which of these statements about P-waves and S-waves is correct?

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

(1)

☒ **A** P-waves and S-waves are transverse waves

☒ **B** P-waves and S-waves are longitudinal waves

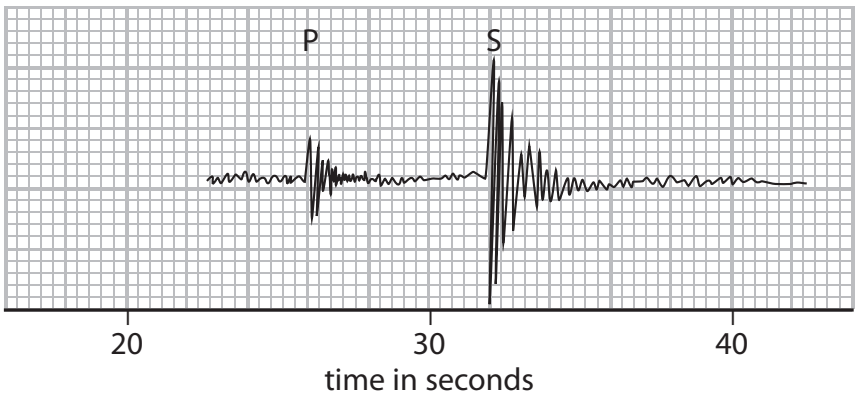
☒ **C** P-waves are longitudinal waves and S-waves are transverse waves

☒ **D** P-waves are transverse waves and S-waves are longitudinal waves

(ii) P-waves and S-waves are detected using a seismometer.
Scientists use the equation below to estimate how far away an earthquake is.

distance from seismometer (in km) = time between P-waves and S-waves arriving (in s) × 8

The chart below shows a P-wave and an S-wave arriving at a seismometer from the same earthquake.



Use the chart and the equation to estimate how far the earthquake is from the seismometer.

(2)

distance from the seismometer = ... km

(iii) Readings on three seismometers at different places are needed to find the location of an earthquake.

Use a diagram to help you explain why three seismometers are needed.

(3)

.....

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(Total for Question 4 = 10 marks)

Heat transfer

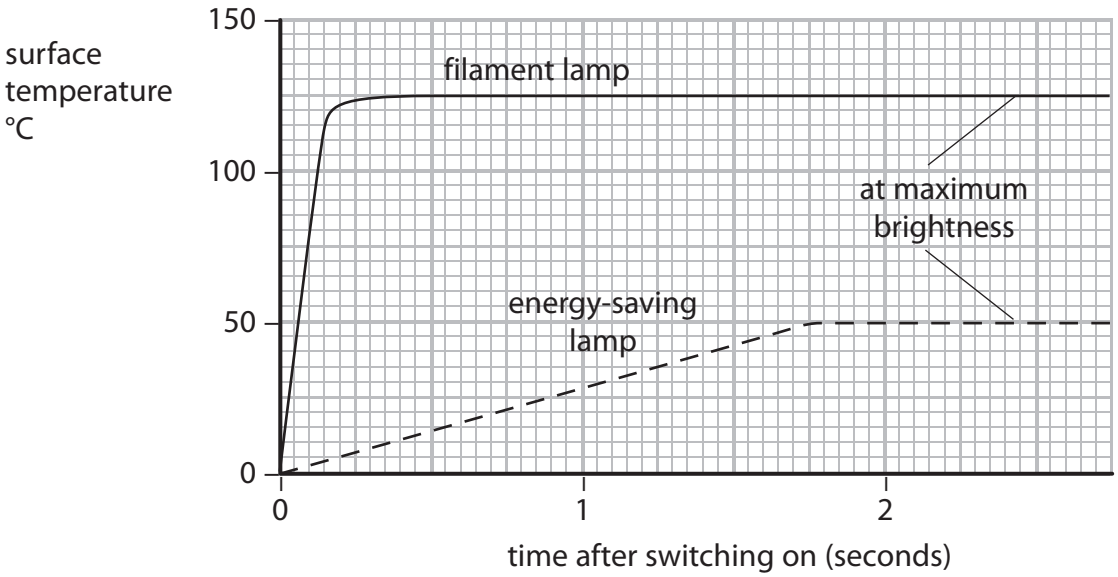
5 (a) The photographs below show two different types of lamp.

filament lamp
Shutterstock

energy-saving lamp
Shutterstock

They both produce the same amount of light energy in the same time.
The surface temperatures of the lamps change in the first few seconds after they have been switched on.

The graph shows this information for both lamps.



(i) Use the graph to state one advantage **and** one disadvantage of using an energy-saving lamp.

(2)

.....

.....

.....

.....

(ii) The efficiency of the energy-saving lamp is 40%.

$$\text{efficiency} = \frac{\text{useful energy output}}{\text{total energy input}} \times 100\,\%$$

The energy-saving lamp is supplied with 15 J of energy.
Calculate the amount of energy transferred to light energy.

(2)

energy = ... J

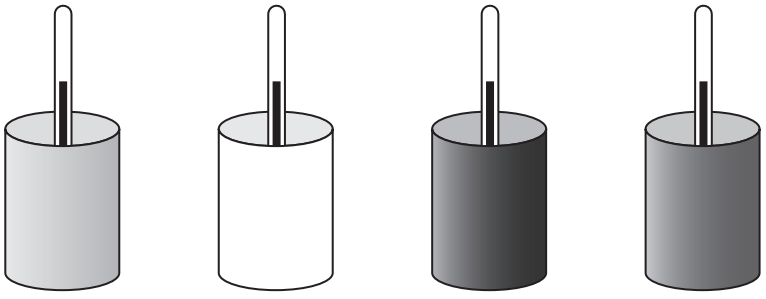
(iii) Why do the lamps reach a constant temperature even though energy is still being supplied to them?

(1)

.....

.....

(b) The same amount of very cold water is poured into four metal containers.
Each one has a different coloured surface.
A thermometer is placed in each container.



A silver | **B** white | **C** dull black | **D** glossy black

In which container will the water warm up quickest?

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

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

*(c) The exhausts from engines of large ships crossing the Atlantic Ocean contain tiny particles. There are two types of these particles: sulfates and black soot.

The sulfates remain in the atmosphere and scatter sunlight. The soot eventually falls to the surface, particularly onto the Arctic ice.

Some people have called for the emissions from these engines to be greatly reduced.

Discuss whether reducing the emissions will be effective in reducing global warming.

(6)

(Total for Question 5 = 12 marks)

The life of stars

6 A cluster is a group of galaxies.
The image shows a section of the Virgo Cluster.

Royal Observatory, Edinburgh/AATB/Science Photo Library

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

A galaxy is

(1)

☒ **A** an interstellar explosion

☒ **B** a collection of stars

☒ **C** a collection of planets

☒ **D** a black hole

(ii) The Virgo Cluster is about 50 million light years away from Earth.
Our Sun is about 150 million km away from Earth.

Why are these two distances measured in different units?

(1)

.....

.....

(b) (i) Light received on Earth from these galaxies shows a **red shift**.

Explain what **red shift** means.

(2)

.....

.....

.....

.....

(ii) Explain why data provided by red shift on its own is not sufficient supporting evidence to prove the Big Bang theory for the origin of the Universe.

(2)

*(c) Scientists have discovered star-forming clouds in the space between the galaxies in the Virgo Cluster.

Our Sun is a star which formed from a cloud. It will eventually become a white dwarf.

Describe the life sequence of a star like our Sun from its formation in a cloud to its white dwarf stage.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

Sample Mark Scheme

Unit P1: Universal Physics (Higher Tier)

Question Number	Answer	Acceptable answers	Mark
1(a)(i)	any **two** from: reflecting (telescope) (1) radio (telescope) (1) infrared (telescope) (1) ultraviolet (telescope) (1) X-ray (telescope) (1) gamma ray (telescope) (1)	 space a named telescope e.g. Hubble Space Telescope	 **(2)**

Question Number	Answer	Additional guidance	Mark
1(a)(ii)	changes speed	changes direction	**(1)**

Question Number	Answer	Mark
1(b)	**C**	**(1)**

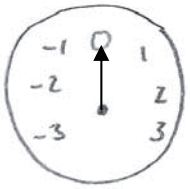
Question Number	Answer	Acceptable answers	Mark
1(c)	a description including the following in a logical order: to magnify (1) the image produced by lens A (1)	to make a bigger image (1) the image of the planet (1)	 **(2)**

Question Number	Answer	Acceptable answers	Mark
1(d)	an explanation linking the following: Galileo saw moons orbiting Jupiter (1) (so) existing ideas that said everything orbits the Earth were not correct (1)	 (but) they thought the Earth was the centre of the Universe (1)	 **(2)**

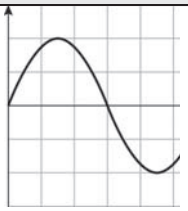
TOTAL: 8 MARKS

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

Question Number	Answer	Acceptable answers	Mark
2(a)(ii)	9 × 0.35 (1) 3.15 (1)	correct answer gains both marks	 **(2)**

Question Number	Answer	Acceptable answers	Mark
2(b)(i)	pointer at zero		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)(ii)	pointer at –2		**(1)**

Question Number	Answer	Mark
2(c)(i)	curve drawn with: higher maximum current (1) shorter time period (1) e.g. 	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(c)(ii)	between +ve and –ve	above and below 0	**(1)**

TOTAL: 8 MARKS

Question Number	Answer	Mark
3(a)	**B**	**(1)**

Question Number	Answer	Mark
3(b)	an explanation linking the following: the wave is transmitted via satellite (1) (so) wave has to travel a long distance (1)	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(c)	express wavelength in m (1) rearrange equation 1) $f = 3.0 \times 10^8 \div 0.34$ (1) $8.8(2) \times 10^8$ Hz (1)	0.34 (m) $f = v/\lambda$ ecf in λ value ecf in λ value 8.8×10^8 Hz scores full marks 880 MHz scores full marks correct units required for marking point 4	**(4)**

Question Number	Answer	Acceptable answers	Mark
3(d)	a discussion to include the following: true that microwaves are not ionising (1) (but) ionisation not the only way to cause damage (1) microwaves cause internal heating in body cells/tissue (1)	microwaves are absorbed by water/cause heating in water (1)	**(3)**

TOTAL: 10 MARKS

Question Number	Answer	Mark
4(a)(i)	an explanation linking the following: movement in the mantle (1) (caused by) convection currents (1)	 **(2)**

Question Number	Answer	Acceptable answers	Mark
4(a)(ii)	a description including the following in a logical order: plates (trying to) **slide** past each other (1) idea of **sudden** slippage (1)	 accept other valid causes of earthquakes	 **(2)**

Question Number	Answer	Mark
4(b)(i)	**C**	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)(ii)	S – P time = 6 (s) (1) distance from seismometer = 48 (km) (1)	± 0.4 ecf time only if a clear attempt has been made to get the time from the chart	 **(2)**

Question Number	Answer	Acceptable answers	Mark
4(b)(iii)	reference to triangulation (1) diagram showing distance arcs drawn from **three** sites (1) earthquake at intersection of distance circles (1)	 award this mark if arcs are drawn from only two sites	 **(3)**

TOTAL: 10 MARKS

Question Number	Answer	Acceptable answers	Mark
5(a)(i)	advantage – lower surface temperature disadvantage – longer to reach maximum brightness	cooler/not so hot saying more efficient is an insufficient answer	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(a)(ii)	energy per second = 15 × 40 ÷ 100 (1) = 6 (1)	transposing equation (ignore errors involving % e.g. 15 × 40) gets this mark ignore unit	**(2)**

Question Number	Answer	Mark
5(a)(iii)	energy is emitted at the same rate it is supplied	**(1)**

Question Number	Answer	Mark
5(b)	**C**	**(1)**

Question Number		Indicative content	Mark
*5(c) QWC		**Reasons for being effective** • black surfaces absorb heat better than white surfaces • currently the (white) ice reflects much solar radiation back from the surface • (black) soot will reduce reflection of heat/sunlight from the ice • reduction of soot emissions will mean less heat absorbed/more heat reflected and so reduces overall warming of the Earth **Reasons for not being effective** • sulfates currently reduce the amount of heat reaching earth's surface • if amounts of sulfate in emissions are reduced then more heat will reach the earth's surface • this accelerates melting of ice and reduces reflection from the ice • increases overall amount of heat absorbed and global warming **Actual effect** depends on the balance of the effects of these two factors **Other credit-worthy arguments** • may be possible to reduce soot particles without reducing sulfates; in which case this would be effective overall Ignore references to acid rain caused by sulfates.	(6)
Level	**0**	no rewardable material	
1	**1-2**	• basic statements such as less soot on the ice will stop it from melting as quickly or less sulfates will mean more heat reaches the surface • many of the points are missing. Probably only effective/not effective will be mentioned • no mention of balance • the answer uses everyday language and the response lacks clarity and organisation. Spelling, punctuation and the rules of grammar are used with limited accuracy	
2	**3-4**	• a detailed description of some positive effects • a detailed description of some negative effects • there may be limited reference to the balance of the two effects • the answer uses some terms and shows some focus and organisation. Spelling, punctuation and the rules of grammar are used with some accuracy	
3	**5-6**	• a thorough description of the positive effects and • a thorough description of the negative effects • a clear understanding that there is a balance to be struck • the answer uses a range of appropriate terms and shows good focus and organisation. Spelling, punctuation and the rules of grammar used with considerable accuracy	

TOTAL: 12 MARKS

Question Number	Answer	Mark
6(a)(i)	**B**	**(1)**

Question Number	Answer	Mark
6(a)(ii)	any **one** from: 1 light year (lyr) is <u>much</u> bigger than a km (1) the galaxy/Virgo Cluster is much further from Earth than the Sun (1) to keep the numbers (reasonably) understandable (1)	**(1)**

Question Number	Answer	Acceptable answers	Mark
6(b)(i)	an explanation to include the following: reduction in observed frequency of light (1) (means) galaxy is moving away from Earth (1)	increase in observed wavelength	**(2)**

Question Number	Answer	Acceptable answers	Mark
6(b)(ii)	an explanation to include: only indicates the Universe is expanding (1) (but) further evidence on CMB is also needed to support Big Bang theory (1)	(but) both the Big Bang and Steady State theories have expansion galaxies in them (1)	**(2)**

Question Number		Indicative content	Mark
*6(c) QWC		**Sequence** • goes from nebula/star-forming cloud to main sequence to red giant to white dwarf **Energy and gravity effects** Effects of gravity • nebula collapses under gravitational forces • gravity continues to pull atoms in Energy considerations • KE - thermal - nuclear reaction starts • energetic particles try to spread out • red giant forms when nuclear fuel used up **Sequence of effects of gravity and energy** • imbalance then balance then imbalance between gravity and energy effects	(6)
Level	**0**	no rewardable material	
1	**1-2**	• a limited description of sequence of star formation with stages missing or in an incorrect order • little or no mention of the effect of gravity or energy (or balance!) • the answer communicates ideas using simple language and uses some scientific terminology. Spelling, punctuation and grammar are used with limited accuracy	
2	**3-4**	• sequence is (mostly) correct • a description of how stars are formed is given, with processes or transitions between some stages mentioned • some reference to the effect of gravity and/or energy in process • a simple attempt at describing balance between gravitational and energetic effects • 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**	• a clear description of sequence of stars is given in the correct order • the part played by gravity and energy is described • a clear idea of imbalance -> balance-> imbalance between gravitational and energetic effects is given • the answer communicates ideas clearly and uses a range of scientific terminology appropriately. Spelling, punctuation and grammar are used with few errors	

TOTAL: 12 MARKS

