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Centre number

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Candidate number

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Surname _____

Forename(s) _____

Candidate signature _____

A-level PHYSICS

Paper 3
Section B Astrophysics

Thursday 14 June 2018 Morning

Materials
For this paper you must have:

- a pencil and a ruler
- a scientific calculator
- a Data and Formulae Booklet.

Time allowed: The total time for both sections of this paper is 2 hours. You are advised to spend approximately 50 minutes on this section.

- Instructions**
- Use black ink or black ball-point pen.
 - Fill in the boxes at the top of this page.
 - Answer **all** questions.
 - You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
 - Do all rough work in this book. Cross through any work you do not want to be marked.
 - Show all your working.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
TOTAL	

- Information**
- The marks for questions are shown in brackets.
 - The maximum mark for this paper is 35.
 - You are expected to use a scientific calculator where appropriate.
 - A Data and Formulae Booklet is provided as a loose insert.



Section BAnswer **all** questions in this section.**0 1**

The Griffith Observatory in Los Angeles includes an astronomical refracting telescope (Griffith telescope) with an objective lens of diameter 305 mm and focal length 5.03 m

0 1 . 1

Calculate the wavelength of light for which the Griffith telescope has a minimum angular resolution of 1.8×10^{-6} rad

[2 marks]

wavelength = _____ m

0 1 . 2

The Griffith telescope is used to observe two point objects which subtend an angle of 1.8×10^{-6} rad at the unaided eye.

The typical human eye has a minimum angular resolution of approximately 3.2×10^{-4} rad

Calculate the focal length of the eyepiece lens so that an observer can just resolve the two objects when observing them through the Griffith telescope.

[3 marks]

focal length = _____ m



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ANSWER IN THE SPACES PROVIDED**



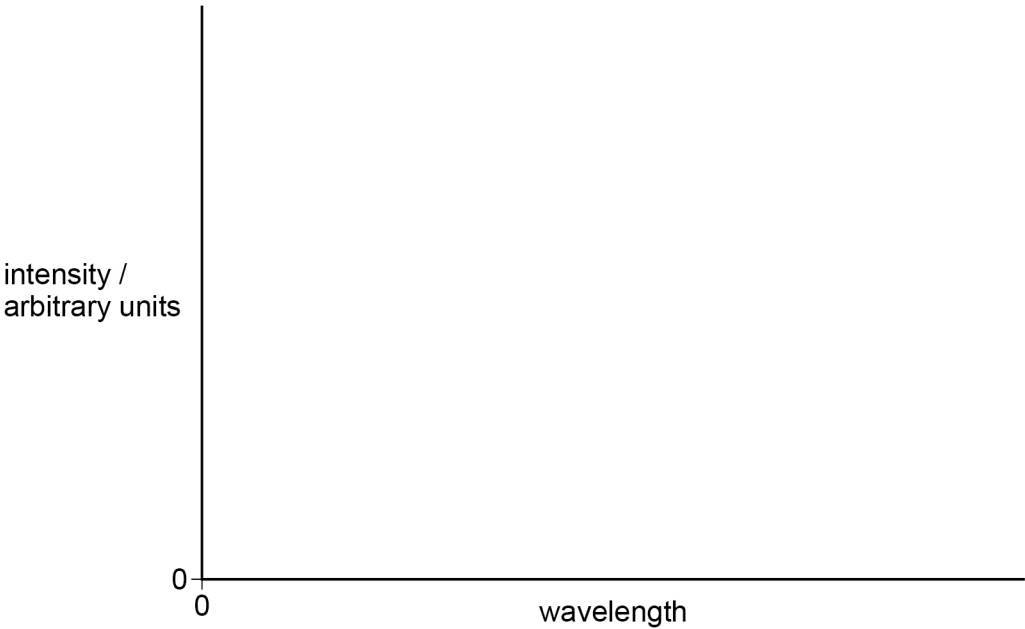
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0 2 . 1

Sketch, on the axes in **Figure 1**, the black-body radiation curve for a typical star.

[2 marks]

Figure 1



0 2 . 2

Explain, with reference to the SI units involved, how the curve you have drawn can be used to determine the black-body temperature of the star.

[3 marks]

Question 2 continues on the next page

Turn over ►



0	2	.	3
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Two stars, 61 Cygnus A and 61 Cygnus B, can be seen very close together in the constellation Cygnus. Early astronomers were unsure whether the two stars form a binary system, or simply appear in the same line of sight.

Table 1 shows some of the properties of the two stars.

Table 1

	Temperature / K	Radius / km	Apparent magnitude
61 Cygnus A	4500	4.7×10^5	5.2
61 Cygnus B	4100	4.1×10^5	6.1

Evaluate whether the data support the suggestion that the two stars form a binary system.

In your answer you should

- compare the two stars as seen by an observer on Earth
- support your evaluation with suitable calculations.

[6 marks]

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03.1

Describe the links between galaxies, black holes and quasars.

[2 marks]

03.2

At a distance of 5.81×10^8 light year, Markarian-231 is the closest known quasar to the Earth. The red shift z of Markarian-231 is 0.0415

Use these data to estimate an age, in seconds, of the Universe.

[4 marks]

age = _____ s



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0 3 . 3

A typical quasar is believed to be approximately the size of the solar system, with a power output similar to that of a thousand galaxies.

Estimate, with reference to the inverse-square law, how much further the most distant visible quasar is likely to be compared to the most distant visible galaxy.

[3 marks]

9

Turn over for the next question

Turn over ►



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