

A-level PHYSICS (7408/3BA)

Paper 3 - Section B (Astrophysics)

Specimen 2014

Morning

Time allowed: 2 hours

Materials

For this paper you must have:

- a pencil
- a ruler
- a calculator
- a data and formulae booklet
- a question paper / answer book for Section A.

Instructions

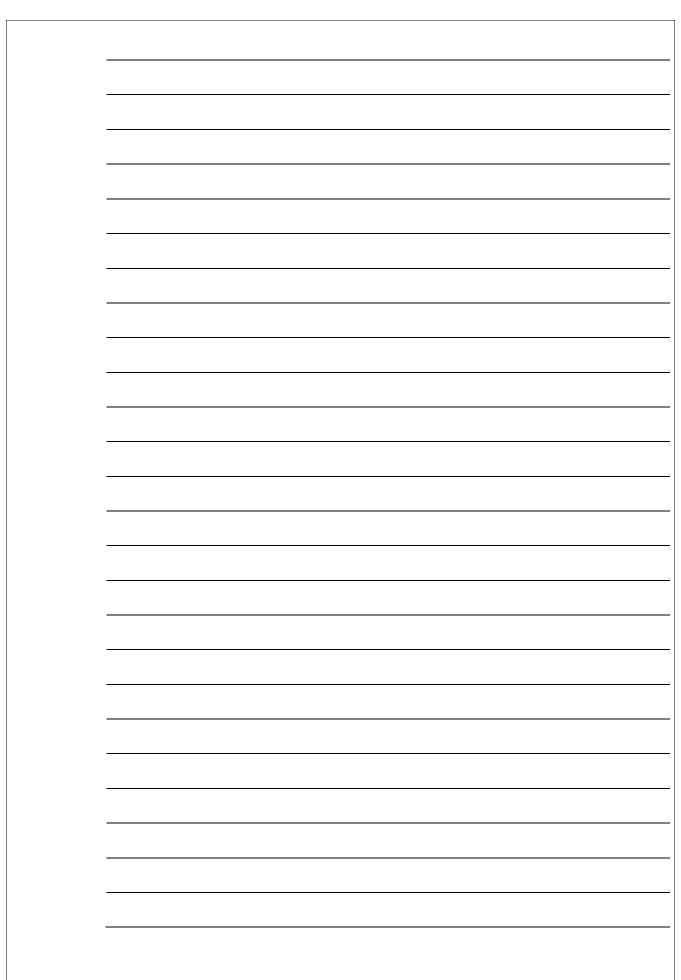
- Answer all questions.
- Show all your working.
- The total time for both sections of this paper is 2 hours.

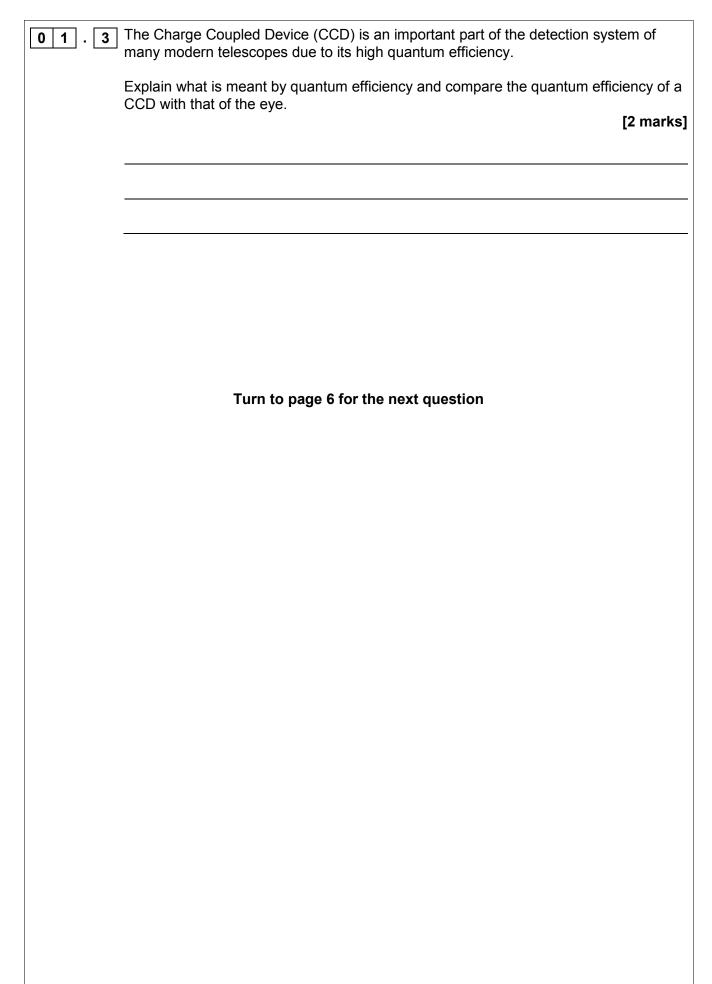
Information

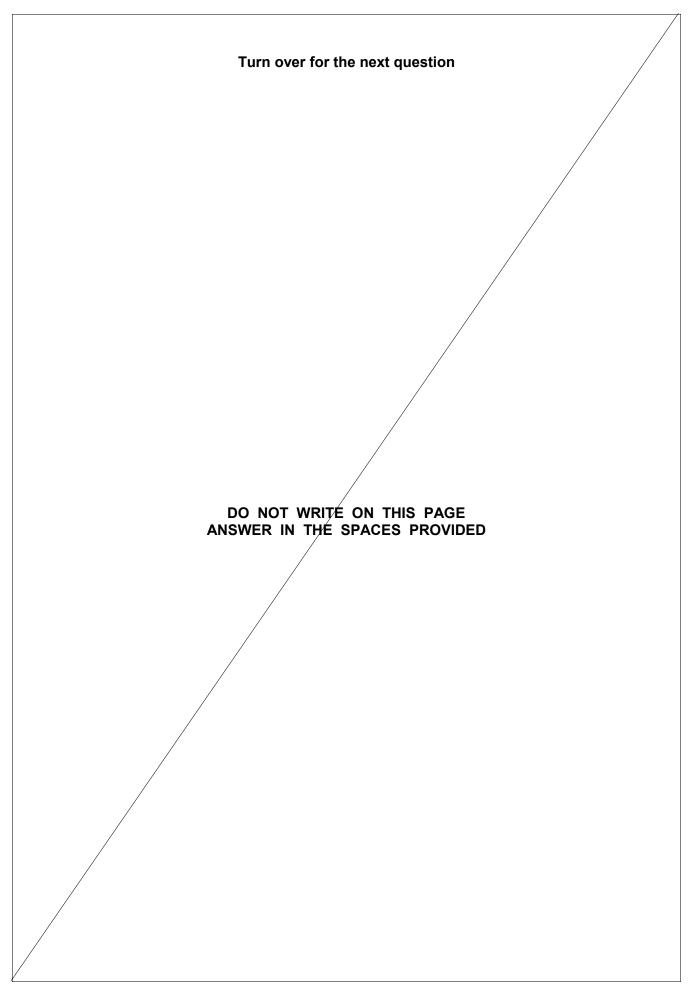
• The maximum mark for this section is 35.

Please write clearly, in block capitals, to allow character computer recognition.		
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orename(s)		
andidate signature		

	:	Section B	
	Answer all qu	uestions in this section.	
0 1	The concave mirrors used in so aberration.	ome reflecting telescopes ca	In suffer from spherical
01.1	Draw a diagram to show what is concave mirror.	s meant by spherical aberra	tion when produced by a
			[2 marks]
01.2	The International Ultraviolet Ex	plorer (IUE) and the Gran T	elescopio Canarias (GTC)
	are two examples of reflecting t		
	Table 1 summarises some of the second seco	ne properties of the two tele Table 1	scopes.
	Name	IUE	GTC
	Objective Diameter	0.45 m	10.4 m
	Location	Geosynchronous Earth orbit	Earth's surface, 2300 m above sea level.
	Spectrum detected	Ultraviolet	Visible and Infrared
	Typical wavelength detected	2.0 x 10 ⁻⁷ m	1.0 x 10 ⁻⁶ m
	Compare the two telescopes in angular resolution.	terms of their location, colle	ecting power and minimum
	Include calculations to support	your comparisons.	[6 marks]







02		angle consists of three perties of the three sta			
	Table 2				
		Altair	Deneb	Vega	
	surface temperature / K	7700	8500	9600	
	apparent magnitude	0.77	1.25	0.03	
	absolute magnitude	2.21	-8.38	0.60	
02.	1 The three stars I	pelong to the same sp	ectral class.		
	State and explain which spectral class they belong to. [2 marks]		rks]		
02.	0 2 . 2 Deduce which of the three stars appears brightest. [2 marks]			rks]	
02.	3 Calculate the dis	stance from Earth to th	e closest of the three	stars. [3 marl	ks]
			distance =		pc

02.4	Deduce which of the three stars is the largest.	3 marks]
02.5	Calculate the wavelength of the peak in the black body radiation curve of Altai	ir. [2 marks]
	wavelength =	m
	Turn over for the next question	

03	Antares is a red supergiant star in the constellation of Scorpio. It has a mass about 18 times that of the Sun. Eventually the star will become a supernova, leaving behind a core that could form a neutron star or a black hole.
03.1	State what is meant by a supernova. [1 mark]
03.2	State the defining properties of a neutron star. [2 marks]
03.3	To become a black hole it is likely that the core would have to have a mass at least twice that of the Sun. Calculate the Schwarzschild radius of a black hole with a mass twice that of the Sun. [2 marks]
	radius = m
03.4	Some scientists are concerned about the consequences for the Earth of a supernova occurring in a nearby part of the galaxy.
	Explain the cause of this concern. [2 marks]

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0 4	In 1999 a planet was discovered orbiting a star in the constellation of Pegasus.
04.1	State one reason why it is difficult to make a direct observation of this planet. [1 mark]
04.2	The initial discovery of the planet was made using the radial velocity method which involved measuring a Doppler shift in the spectrum of the star. Explain how an orbiting planet causes a Doppler shift in the spectrum of a star. [2 marks]
04.3	The discovery was confirmed by measuring the variation in the apparent magnitude of
	the star over a period of time. Explain how an orbiting planet causes a change in the apparent magnitude of a star. Sketch a graph of apparent magnitude against time (a light curve) as part of your answer.
	[3 marks]
	END OF QUESTIONS

There are no questions printed on this page.

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