AQA A-LEVEL PHYSICS · 7408

PHYSICS



EXAM QUESTION PACK

3.9.1 TELESCOPES: OPTICAL

SCORE	PERCENTAGE
/29	%

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Q1.

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

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

wavelength = _____ m

(2)

(b) 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.

focal length = _____ m

(3)

(c) The asteroid Apophis has a diameter of 325 m

It has been calculated that, in 2029, its distance of closest approach to the Earth's surface will be 3.0×10^{4} km

The Griffith telescope may be used to view Apophis using the eyepiece calculated in question (b)

Deduce whether this telescope is suitable to obtain a detailed view of Apophis. Support your answer with a calculation.

_____

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(3)

(Total 8 marks)

Q2.

Draw the ray diagram for a Cassegrain telescope. Your diagram should show the paths of two rays, initially parallel to the principal axis, as far as the eyepiece.

(Total 2 marks)

Q3.

The Kielder Observatory in Northumberland includes two optical telescopes attached to the same mount, so that they can be used to view the same object.
Some of the properties of these telescopes are summarised in the table.

Telescope	Type	Objective diameter/mm
A	refractor	70
B	refractor	400

(a) The telescopes are used to view the same object.

Suggest which telescope in the table produces the brighter image.
Support your answer with a suitable calculation.

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(3)

(b) The minimum angular resolution of a telescope can be determined using the Rayleigh criterion.

Explain what is meant by the Rayleigh criterion.

(2)

(c) Discuss which of the two telescopes in the table would be better at resolving the images of two objects that are close together.

(2)

(Total 7 marks)

Q4.

(a) Draw a ray diagram for an astronomical refracting telescope in normal adjustment. Your diagram should show the paths of **three** non−axial rays through both lenses.

Label the principal foci of the two lenses.

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(2)

(b) Most modern optical observatories make use of reflecting telescopes rather than refracting telescopes.

Discuss the principal optical advantages of reflecting telescopes.

(4)

(c) The Greek astronomer Hipparcos used naked-eye observations to develop a scale for comparing the apparent magnitude of stars.

Explain what is meant by apparent magnitude and describe the main features of the Hipparcos scale.

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(6)
(Total 12 marks)

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