



QUESTION WORKBOOK

Telescopes across the spectrum

Astrophysics · Year 13

AQA 3.9.1.3, 3.9.1.4

10 questions · 31 marks

NAVY SCREEN EDITION

SECTION A · Warm-up

A1 Explain why ultraviolet and X-ray telescopes must be placed in orbit, while radio telescopes work at ground level. [2]

A2 State the Rayleigh criterion for two point sources to be just resolved by a telescope of aperture D observing at wavelength λ . [2]

A3 Define the quantum efficiency of a detector, and give typical values for a CCD and for the human eye. [2]

SECTION B · Standard

B1 Calculate the smallest angle a telescope with a 5.0 m mirror can resolve when observing at 550 nm. [3]

- B2** A dark-adapted pupil is 5.0 mm across and works at about 500 nm. A radio dish 64 m across observes at 0.21 m. Calculate the resolving power of each and state which can resolve the finer detail. [4]

- B3** Calculate the ratio of the collecting powers of a 10 m telescope and a 2.0 m telescope. [3]

- B4** A space telescope has a 2.4 m mirror and observes at 550 nm. The Moon is 3.8×10^8 m away. Estimate the smallest feature it can resolve on the lunar surface. [4]

SECTION C · Stretch

- C1** Calculate the dish diameter a radio telescope observing at 0.21 m would need to match the resolving power of a 15 cm optical telescope working at 500 nm. Comment on your answer. [4]

- C2** An astronomy society is debating whether to image a faint galaxy by eye or with a CCD camera. Give four distinct reasons the CCD will out-perform the eye. [4]

- C3** Describe one way the structure or siting of an infrared telescope and of an X-ray telescope must each differ from an ordinary optical telescope, giving the reason in each case. [3]