

Name of the Student: _____

Max. Marks : 19 Marks

Time : 19 Minutes

Q1.

The Chandra X-ray Observatory was launched into orbit in 1999. It is used to observe hot and turbulent regions of space.

- (a) Explain why X-ray telescopes need to be in orbit.

(1)

- (b) In 2000, the Chandra telescope was used to observe a *black hole* in Ursa Major.

- (i) Explain what is meant by a black hole.

(1)

- (ii) The black hole is believed to have a mass 7 times that of the Sun. Calculate the radius of its event horizon.

$$\text{mass of the Sun} = 2.0 \times 10^{30} \text{ kg}$$

radius = _____ m

(2)

- (c) Chandra makes use of a charge coupled device (CCD) to detect the X-ray photons. Describe the processes involved in the detection of photons by a CCD.

Q2.

- (a) A sample of conducting putty is rolled into a cylinder which is 6.0×10^{-2} m long and has a radius of 1.2×10^{-2} m.

resistivity of the putty = $4.0 \times 10^{-3} \Omega\text{m}$.

Calculate the resistance between the ends of the cylinder of conducting putty.
Your answer should be given to an appropriate number of significant figures.

answer = _____ Ω

(4)

- (b) Given the original cylinder of the conducting putty described in part (a), describe how you would use a voltmeter, ammeter and other standard laboratory equipment to determine a value for the resistivity of the putty.

Your description should include

- a labelled circuit diagram,
- details of the measurements you would make,
- an account of how you would use your measurements to determine the result,
- details of how to improve the precision of your measurements.

The quality of your written communication will be assessed in this question.

(8)
(Total 12 marks)