Name of the Student:_____
Max. Marks : 23 Marks **Time : 23 Minutes**

Q1.

(a) Describe the links between galaxies, black holes and quasars.

_____

_____

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_____

_____

_____

(2)

(b) 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.

age = _____ s

(4)

(c) 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.

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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)
(Total 9 marks)

Q2.

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.

(3)

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

Explain what is meant by the Rayleigh criterion.

_____

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(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)

Q3.

(a) Sketch, on the axes, the light curve for a typical type 1a supernova.
Label the axes with suitable scales.

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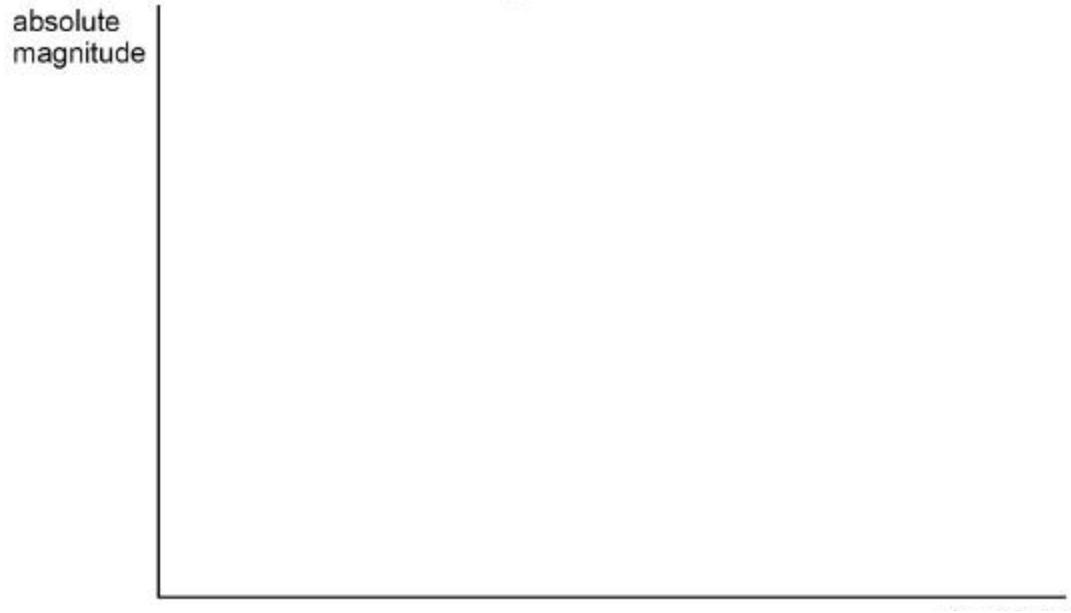

(3)

(b) Type 1a supernovae can be used as standard candles.

Explain what is meant by a standard candle.

(1)

(c) Measurements of type 1a supernovae in 1999 led to a controversy concerning the behaviour of the Universe.

Describe this controversy and how the measurements led to it.

(3)

(Total 7 marks)

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