**Name of the Student**:_____
**Max. Marks : 26 Marks** **Time : 26 Minutes**

## Q1.

(a) The table summarises some of the properties of two stars in the constellation of Ursa Minor.

| **name** | **apparent magnitude** | **radius of star / radius of the Sun** | **spectral class** |
|---|---|---|---|
| Polaris | 2.0 | 50 | F |
| Kocab | 2.0 | 50 | K |

(i) Using these data, describe and explain **one** similarity and **one** difference in the appearance of the two stars as seen with the unaided eye by an observer on the Earth.

similarity_____

_____

_____

difference_____

_____

_____

**(2)**

(ii) Deduce which of the two stars is further from the Earth.

_____

_____

_____

_____

_____

_____

**(3)**

(b) Ursa Minor also contains the galaxy NGC 6251. Measurements indicate that the light from the galaxy has a red shift, *z*, of 0.025 and that the galaxy is 340 million light years from Earth.

(i) Use these data to calculate a value for the Hubble constant.

value _____ k $ms^{-1}$ $Mpc^{-1}$

**(3)**

(ii) Use your answer to part (b)(i) to estimate a value for the age of the Universe. State an appropriate unit for your answer.

age _____ unit _____

**(3)**

**(Total 11 marks)**

## Q2.

(a) Bellatrix and Betelgeuse are stars in the constellation of Orion. Some of their properties are summarised below.

| | **Bellatrix** | **Betelgeuse** |
|---|---|---|
| absolute magnitude | –6.0 | –2.7 |
| apparent magnitude | 0.4 | 1.6 |
| black-body temperature / K | 22 000 | 2 400 |

(i) Explain what is meant by absolute magnitude.

_____

_____

_____

**(1)**

(ii) Which of the two stars is closer to the Earth? Explain your answer.

_____

_____

_____

**(1)**

(b) (i) Calculate the wavelength of the peak intensity in the black-body radiation curve of Bellatrix.

answer = _____ m

**(2)**

(ii) Sketch the black-body radiation curve for Bellatrix. Label the wavelength axis with a suitable scale.


**(3)**

(c) Detailed analysis of the light from both stars reveals the presence of prominent absorption lines in the spectra.

(i) To which spectral class does Bellatrix belong?

_____

**(1)**

(ii) Prominent features in the Bellatrix spectrum are the Balmer absorption lines due to hydrogen. State the other element responsible for the prominent absorption lines in the spectrum of Bellatrix.

_____

**(1)**

(iii) Why does the spectrum of Betelgeuse not contain prominent Hydrogen Balmer absorption lines?

_____

_____

_____

**(1)**

**(Total 10 marks)**

## Q3.

Cygnus A may be the nearest quasar yet discovered.

(a) Cygnus A has a redshift, z, of 0.057.
Calculate the distance to Cygnus A. State an appropriate unit.

answer = _____ unit = _____

**(4)**

(b) The first quasars were discovered in the 1950s. What property of quasars led to their discovery?

_____

_____

**(1)**

**(Total 5 marks)**