Any Calculator
No Dictionary
No Special Requirements

School of Physics and Astronomy

DEGREE OF BSc & MSci WITH HONOURS

FIRST YEAR EXAMINATION

03 20521

INTRODUCTION TO ASTROPHYSICS

The total time allowed is 1 hour

MAY/JUNE 2010

Students should answer two questions.
If more than two questions are attempted only the first two attempted questions will be marked.

Calculators may be used in this examination but must not be used to store text.
Calculators with the ability to store text should have their memories deleted prior to the start of the examination.

Two tables of physical constants and units that may be required will be found at the end of this question paper.

Students must answer two questions out of three.
If you answer more than two questions, only the first two will be marked.

1. (a) If you wanted to make optical observations of the galaxy M81, at RA=9h55m33s, Dec=+69d3m55s, explain what time of year you would choose, and what local sidereal time would be best for making your observation. Would an observatory in Australia be suitable? **[5]**

   (b) Given that the Moon's orbital plane is close to that of the Earth, explain with the aid of an appropriate diagram whether the full moon is higher or lower in the night sky in the winter (compared to summer) in the northern hemisphere. Is the same true in the southern hemisphere? **[5]**

2. (a) The bright red star Betelgeuse has a parallax of 5 mas (where 1 mas=10^{-3} arcsec), determined by the Hipparcos satellite. Ultra-high resolution imaging with an adaptive optics telescope has resolved the stellar diameter at 44 mas. Calculate the radius of the star, and comment on the comparison of this to the radius of the Earth's orbit around the Sun. **[5]**

   (b) Betelgeuse is a red supergiant star - an evolved massive star close to the end of its life. Sketch the internal structure of such a star, and explain how and why it will end its life as a star. **[5]**

3. (a) A type Ia supernova is discovered in a galaxy at redshift z=0.1, and found to peak at a brightness 10 magnitudes fainter than a similar supernova in a nearby galaxy, which is known to lie at a distance of 4 Mpc. Use this to estimate the value of the Hubble constant. **[5]**

   (b) Use this result for H_0 to derive a rough estimate for the age, in years, of the Universe, explaining any assumptions you make. How would this age be affected if the expansion of the Universe has been progressively slowing down? **[5]**