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 2008

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.

TURN OVER

Students must answer two questions out of three.

If you answer more than two questions, only the first two will be marked.

- 1. (a) Explain why Polaris will no longer be the pole star in AD 5000. [4]
 - (b) If Polaris has a parallax of 7.6×10^{-3} arcsec and an apparent V band [6] magnitude of 1.97, calculate its distance in parsec, and its luminosity in units of the solar luminosity. (The absolute magnitude of the Sun is M_V =+4.83). Comment briefly on the nature of Polaris, given that it has a spectral class of F.
- (a) Explain what is meant by hydrostatic equilibrium. Discuss what [4] would happen to any star in which the hydrostatic balance was seriously disturbed.
 - (b) For a giant star with a radius 50 times that of our Sun, and a mass [6] of 5M_☉, calculate the approximate timescale on which any hydrostatic imbalance would be corrected. Comment briefly on the relevance of this to Cepheid variables.
- (a) Why is it believed that supermassive black holes are located at the [4] centres of many galaxies? Describe at least two pieces of evidence.
 - ^(b) A quasar is believed to contain a $10^9 M_{\odot}$ black hole. Calculate the ^[6] radius of the event horizon of this black hole. What is the shortest timescale on which the brightness of the quasar should be able to vary substantially?