

A23575

Any Calculator

**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 2009

***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) Use the Virial Theorem to explain the way in which the internal temperature of a massive star changes through its life, from the main sequence until its death. [5]
- (b) Explain how the lifetime of a star on the main sequence varies with stellar mass, and estimate the life-span of a $10 M_{\odot}$ star, commenting on any assumptions you make. [5]
2. (a) Given that the Sun has an apparent magnitude of -26.8, calculate its absolute magnitude. Use this result to estimate the number of stars within a galaxy which has an absolute magnitude $M=-20$. What is the main deficiency in your calculation? [6]
- (b) If this galaxy has a constant rotation speed of 200 km s^{-1} which extends to a radius of 50 kpc, estimate its total mass and comment on whether this can be accounted for by its stellar content. [4]
3. (a) Why are type Ia supernovae so useful for determining the distances of galaxies? Give three reasons. [3]
- (b) If the core of a $10 M_{\odot}$ star collapses to form a $1 M_{\odot}$ neutron star, estimate the energy released, and compare this with the total energy radiated during its lifetime on the main sequence, assuming that hydrogen fusion generates $6 \times 10^{14} \text{ J kg}^{-1}$ of energy, noting any assumptions you make. Briefly describe the main consequences of the collapse of the core for the star and its surroundings. [7]