

UNIVERSITY COLLEGE LONDON

University of London

EXAMINATION FOR INTERNAL STUDENTS

For The Following Qualifications:–

Coll Dip UG Dip

Astronomy DP12: The Sun, the Stars and the Search for Life

COURSE CODE : ASTRDP12

UNIT VALUE : 0.50

DATE : 16-MAY-06

TIME : 18.30

TIME ALLOWED : 2 Hours

Answer **THREE** questions from Section A and **THREE** questions from Section B.

You are advised to spend no more than 10 minutes on each Section A answer, and about 30 minutes on each Section B answer.

The numbers in square brackets indicate the provisional allocation of maximum marks for sub-sections of the question.

SECTION A

1. Briefly describe the main characteristics of the solar photosphere. [7]

2. Define the luminosity, L , and effective temperature, T_{eff} , of a star. [4]

Explain, with the aid of an equation, why dwarf, giant and supergiant stars with the same T_{eff} can be identified. [3]

3. Briefly describe the object that is formed in the final stage of evolution of (i) a 1 solar mass star, and (ii) a 50 solar mass star. [7]

4. Describe a theory for the formation of the Solar System, highlighting how it can explain the existing observational constraints and mentioning any problems that it may have. [7]

5. Briefly describe three indirect detection methods for extra-solar planets, specifying what physical principle each is based upon. [7]

6. Briefly describe the six stages of the beginning of life according the chemosynthesis model. [7]

SECTION B

7. Give an account of the physical process by which the Sun generates its energy. [8]

With the aid of a diagram, explain how this energy is transported from the centre to the surface of the Sun. [6]

Briefly describe the solar neutrino problem and explain how it has been resolved. [6]

8. Sketch and fully label a Hertzsprung-Russell (H-R) diagram. Indicate the main sequence and the location of the Sun, and the approximate positions of the red giant, red supergiant and white dwarf stars. [8]

What parameter determines the position of a star on the main sequence? How does this parameter vary along the main sequence? [2]

Explain how an H-R diagram can be used to estimate the *age* of a star cluster. What assumption has been made about the stars in the cluster? [5]

Explain how an H-R diagram can be used to estimate the *distance* of a star cluster. What assumption has been made about the stars in the cluster? [5]

9. Describe the different evolutionary stages of a 1 solar mass star, from its appearance on the main sequence to the ejection of a planetary nebula. [20]

10. Explain what is meant by Panspermia. [4]

List the six main arguments of Hoyle and Wickramasinghe's theory that support the theory of Panspermia. [6]

The idea of Panspermia was originally dismissed by astronomers. Explain the arguments against it and how they can be resolved. [6]

How can the ideas of Panspermia and chemosynthesis be combined to form alternative theories for the origin of life on Earth? [4]

11. Describe the Drake equation and explain all the factors appearing in this equation. [12]

What would be a reasonable estimate for the number of civilisations in our Galaxy and why? [8]

12. Describe Titan's characteristics in relation to its potential habitability. [10]

Describe Europa's characteristics in relation to its potential habitability: [10]