

**Answer all questions. Some questions may require you to consult other sources: if so, remember to reference the sources used in standard style (see the Department's web page on "Plagiarism and Collusion" for instructions on referencing). Always use your own words, unless there is justification for a brief direct quote—if there is, use quotation marks. This exercise counts 5% towards your total module mark.**

1. On the first page of the paper, Leavitt refers to "the determination of absolute magnitudes". Explain why it is clear that she does **not** mean by this "magnitudes as measured at a distance of 10 pc", as would be the modern usage. What *does* she mean by "absolute magnitudes", and why are they difficult to determine for faint objects? [3]
2. Leavitt says that the measurements are difficult because of "the large area covered by the two regions, the extremely crowded distribution of the stars contained in them, the faintness of the variables, and the shortness of their periods." It's obvious that the fainter a star is, the more difficult it is to measure accurately. Explain why the other issues mentioned by Leavitt cause problems. [3]
3. In hindsight, it appears remarkable that Leavitt never mentions distance determination as a possible application of her relationship. Why do you think this is? What is needed to make the relationship a useful tool for distance determination, and what are the problems associated with this? [3]
4. The simple idea of a single period-luminosity relation applicable to all so-called Cepheid variables held sway for many years, but has now been superseded. Briefly but thoroughly, discuss the modern state of Cepheid period-luminosity relations. Your discussion should include
  - different classes of "Cepheid" variables;
  - different forms of the relationship;
  - possible systematic effects.[6]