**PHYSICS 113**
Practice Test #1
**SOLUTIONS**

## MULTIPLE CHOICE:

1. b
2. d
3. a
4. b
5. b
6. d
7. d
8. c
9. c
10. b
11. b
12. a
13. d
14. c
15. d
16. c
17. a
18. e
19. d
20. a
21. b
22. b

## SHORT ANSWERS:

1. Stars near the N/S celestial pole will appear to move in circles about the poles. Stars near the celestial equator will normally rise and set and seem to be moving in straight lines.

2. Mauna Kea is located on an extinct volcano at a very altitude in Hawaii. The altitude ensures that there is less atmosphere (and water vapour) to look through. Also there is little light pollution. Since the site is near the equator, most of the stars on the celestial sphere can be seen at some time during the year.

3. The Hubble Space Telescope is an orbiting optical telescope. It provides superior optical images because: (i) it does not have to contend with atmospheric effects (e.g., distortion/turbulence, water vapour/clouds); (ii) it can operate 24 hours a day (always pointed away from the Sun); (iii) it can be

used to observe all stars on the celestial sphere; and, (iv) it experiences little light pollution.

4. The speed of the star can be determined from the Doppler Effect. To use it, we must convert the frequency ($\nu$) to wavelength ($\lambda$) using the formula: $(\nu)(\lambda) = c = 3 \times 10^8$ m/s. Thus $\nu = (c / \lambda)$. For $\nu = 10^6$ Hz, $\lambda = 3 \times 10^8 / 10^6 = 300$ m. Also, for $\nu = 1.1 \times 10^6$ Hz, $\lambda = 3 \times 10^8 / (1.1 \times 10^6) = 273$ m. Thus $\Delta\lambda = (273\text{-}300) = -27$ m. According to the Doppler Effect (see Assignment #3), $v = c\ (\Delta\lambda / \lambda) = 3 \times 10^8\ (-27/300) = -\ 2.7 \times 10^7$ m/s. Since the wavelength of the gas emitted by the moving star is smaller (273m compared to 300m) than the wavelength at rest, thus the star's light is blueshifted. Therefore the star's relative motion is towards us. Note that the negative sign in the value of v also tells us the same thing (i.e., motion towards us).

5. Stellar temperatures can be determined using Wien's Law once the wavelength of the maximum intensity of radiation has been measured. According to the law, $T = 2900$ (microns) / ($\lambda_{max}$) where T is in units of Kelvin. There are other ways to determine temperatures (from the properties of the spectra).