Astrophysics Yr 2 Class test 1: 2010 **NAME:**_____

1) Calculate the energy in joules of a 3647Å photon.

Planck's constant = 6.626×10^{-34}joule sec.

Speed of light = 3.0×10^{8}metres per sec.

$$E = \frac{hc}{\lambda} = \frac{6.626 \times 10^{-34} \times 3.0 \times 10^{8}}{3647 \times 10^{-10}} = 5.45 \times 10^{-19} joules$$

(3 marks)

2) The declination of the star Mizar is +54°. What is its altitude at lower culmination from Salford whose latitude is 53× 30' north?

At Dec 54° Mizar is 36° from the NCP. At Salford altitude of NCP = 53°.5.

Hence altitude of Mizar at lower culmination is 53°.5 - 36° = 17°.5.

(3 marks)

3) Calculate the value of the solar constant for the Earth.

The Sun's luminosity = 3.83 × 10^{26} watts.

Astronomical Unit = 1.496 × 10^{11}m.

Surface area of sphere of 1 A.U. radius = $4\pi r^2 = 4\pi \times 2.238 \times 10^{22} m^2 = 2.8 \times 10^{23} m^2$

Solar constant = $\frac{3.83\times10^{26}}{2.8\times10^{23}} = 1.367 \times 10^{3} watts\ per\ square\ metre.$

(3 marks)

4) State Kepler's third law for the Solar System where orbital periods are given in Earth sidereal years and the semi major axes of the planets' orbits are given in astronomical units.

$$\frac{a^3}{P^2} = 1$$

(3 marks)

5) The apparent magnitude of the star Betelgeuse is 0.4. Use the distance modulus formula:

m - M = 5Log D – 5 to calculate the absolute magnitude of Betelgeuse whose parallax = 5×10^{-3}arcsec.

D = 1/parallax = 200pc

M = m – 5Log D + 5

= 0.4 –(5× 2.3) + 5 = -6.1

(3 marks)

6) Star 'a' is observed to be 4.5 times brighter than star 'b'; The apparent magnitude of star b is 3.5. Calculate the apparent magnitude of star a..

$$\frac{f_a}{f_b} = 4.5 = 2.512^{3.5-m_a}$$

Take logs;

Log 4.5 = $(3.5 - m_a) \times 0.4$

$m_a = 3.5 - 2.5\text{Log } 4.5 = 1.9$

(5 marks)