Quiz 1

NAME: _____ SCORE: _____

Subject: Introduction to Astrophysics and Cosmology
Date: Thursday 24 November 2022
Duration: 60 minutes
Credits: 22 points, Type of evaluation: Quiz

This quiz consists of closed-book concept questions. Provide answers to the following items. Each question is 1 point.

1. What is the name of the two coordinates in the equatorial coordinate system?

   Right ascension R.A.
   Declination δ

2. How is the absolute magnitude of an object defined?

   The magnitude an object would have if it would be placed at a distance of 10 pc.

3. How is the bolometric magnitude of an object defined?

   The magnitude from the radiation at all wavelengths.

4. If we have two stars: Vega with apparent magnitude 0.03 and Deneb with apparent magnitude 1.25, which star looks brighter?

   Vega - The magnitude scale goes decreasing numbers for brighter objects

5. Calculate the absolute magnitude of Vega. The distance to Vega is 7.68 pc.

   $M = m - 5 \log_{10}\left(\frac{d}{10}\right) = 0.03 - 5 \cdot \log_{10}\left(\frac{7.68}{10}\right) = 0.603$ mag

6. If the B-V colour of Vega is 0.0 and the B-V colour of Deneb is 0.09, which star is redder?

   Deneb
   the B colour stands for blue, V for visual and is the redder band.
   Also the magnitude scale goes reverse so redder objects have larger B-V colour.

7. What is the definition of a parsec?

A parsec is the distance to an objects so that its paralax is 1".

8. What kind of places are generally good for building optical telescopes and what is the reason?

High mountains, with stable weather. Less atmosphere for the radiation to travel trough. Less absorption by water vapour.

9. What does the resolution of an optical telescope depend on?

$\Theta = 1.22 \frac{\lambda}{D}$ wavelength of the radiation and the diameter of the telescope

10. What is the name of the method that allows to combine several radio telescopes and use them together as one telescope?

interferometry

11. Name two wavelength regimes where it is only possible to directly detect radiation with space telescopes?

X-rays

γ-rays

12. What are the two coefficients called that we use to describe the radiative properties of matter?

emission coeficient

absorption coeficient

13. What does Kirchof's law describe?

In thermodynamical equilibrium the source function is the Planck Blackbody function. $S_\nu = B_\nu(T)$ or $j_\nu = \alpha_\nu B_\nu(T)$

14. What is the source function?

The ratio between the emission and absorption coeficients

$$S_\nu = \frac{j_\nu}{\alpha_\nu}$$

15. What does the Bolzmann distribution law describe?

Describes the fraction of excited atoms compared to the number of atoms in the ground state

16. What does the Saha equation describe?

The fraction of ionized atoms compared to the neutral atoms.

17. Describe shortly what the grey atmosphere model refers to?

A simplification that asumes that the α_ν absorption coeficient does not change with frequency

18. What is a limitation of the grey atmosphere model? (What is a phenomenon that it can not explain?)

It can not explain spectral lines.

19. What does limb darkening refer to?

The intensity of the radiation comming from an object depends on the angle that the radiation has with the radius of the objects. Due to this the edge of the solar disk has lower intensity radiation compared to the centre of the disk.

20. What is the Thompson scattering?

Free electrons scattering radiation.

21. How can we explain the production of absorption lines in the spectrum of stars?

The absorption coeficient depends on the frequency and different layers of the stellar atmosphere have different absorption coeficients.

22. What is the equivalent width of spectral lines?

The integrated fractional dip of the spectral lines is called the equivalent width

$$W_\lambda = \int \frac{I_c - I_\lambda}{I_c} d\lambda$$

$I_c \rightarrow$ continuum intensity

$I_\lambda \rightarrow$ spectral line intensity