**ASTROPHYSICS - TELESCOPES**

12. (a) What is meant by the principal focus of a convex lens?

(b) Draw a ray diagram showing how a convex lens of focal length 10cm forms an image of an object placed 30cm away from this lens.

(c) For the lens above, calculate the image position if the object distance was 4cm.

13. (a) State what is meant by the magnifying power of a telescope.

(b) Calculate the magnifying power of a refracting telescope that has an objective of focal length 120cm and an eyepiece of focal length 5mm.

(c) What have you assumed in part (b)?

14. (a) Sketch a ray diagram of a Cassegrain telescope.

(b) Give two advantages of reflecting telescopes over refracting.

(c) What is ‘spherical aberration’?.

15. (a) What is the ‘Rayleigh criterion’?

(b) Calculate the resolving power of a telescope that uses an objective of diameter 2.0m to collect radiation of wavelength 7μm.

(c) Show that a telescope using red light would have ten times the resolving power of that in part (b).

16. (a) Outline the operation of a Charge coupled device.

(b) What is meant by ‘quantum efficiency’?

17. Compare and contrast radio and optical telescopes.

**ASTROPHYSICS - STARS**

18. (a) Explain what is meant by a ‘light year’.

(b) Draw a diagram to explain how distance in parsecs is determined.

19. (a) Explain the difference between absolute and apparent magnitude.

(b) Calculate the absolute magnitude of a star that has an apparent magnitude of +4.0 and lies at a distance of 30 light years.

20. (a) Draw a graph showing the general shape of a black body curve.

(b) Add a second line showing the change caused with a higher temperature.

(c) Explain how Stefan’s and Wien’s laws are illustrated by your curves..

21. (a) Calculate the surface temperature and luminosity of a star that emits a peak wavelength of 700nm and has a radius of 7.0 x 105 km.

(b) State an assumption you have made.

22. (a) List, in order, the spectral classes of stars starting with the hottest.

(b) Which classes of stars show prominent Balmer absorption lines?

23. (a) Sketch the Hertzsprung-Russell diagram, show numerical scales and label the main regions.

(b) With reference to your Hertzsprung-Russell diagram outline the evolution of a Sun like star from formation to white dwarf stage.

24. (a) Explain what the following are: (i) supernovae; (ii) neutron stars; (iii) black holes.

(b) Why will the Sun not become any of the above?

25. Explain how type 1a supernovae can be used as standard candles to determine distances.

26. Calculate the radius of the event horizon for a black hole of mass 7.0 x 1030 kg.

**ASTROPHYSICS - COSMOLOGY**

27. (a) What is the Doppler Effect?

(b) Explain why distant galaxies often show 'Red Shift'

(c) The light from a distance galaxy shows a frequency shift to the red end of the spectrum of 1.5 x 1014 Hz with a spectral line that from the Sun has a frequency of 6.0 x 1014 Hz. How is the distant galaxy moving compared with the Sun?

28. (a) What is Hubble's law?

(b) How far away is the galaxy in Q27 in light years?

(d) Explain the connection between this constant and the age of the universe.

29. What is the evidence for the ‘Big Bang’ theory of the origin of the Universe.

30. (a) What is ‘dark energy’?

(b) What observations led to its proposal?

31. (a) What is a Quasar?

(b) State three characteristics of a quasar.