Name: _____

Due Date: _____

D1 Stellar Quantities

Understandings:

- Objects in the universe
- The nature of stars
- Astronomical distances
- Stellar parallax and its limitations
- Luminosity and apparent brightness

Equations

$$d(parsec) = \frac{1}{p(arc-second)}$$

$$L = \sigma A T^4$$

$$b = \frac{L}{4\pi d^2}$$

Part 1. Define the following terms. Write neatly. Draw a detailed image if you have to.

The solutions can be found on the YouTube channel Go Physics Go:

https://www.youtube.com/@gophysicsgo/playlists

1. Star map

2. Celestial:

3. Comet

4. Meteor

5. Meteorite

6. Nebulae

7. Interstellar

8. Star

9. Nuclear fusion

10. Thermal gas pressure

11. Radiation pressure

12. Gravitational pressure

13.Stellar equilibrium

14.Main sequence star

15.Binary stars

16.Galaxy

17.Milky Way

18.Clusters of galaxies

19.Super clusters

20.Stellar cluster

21.Global cluster

22.Open cluster

23.Constellation

24.Planetary system

25.Planet

26.Sun

27.Solar system

28.Moon

29.Ellipse/oval

30.Foci

31.Period

32.Asteroid

33.Asteroid belt

34.Light year

35.Astronomical unit

36.Parsec

37.Diameter of the observable universe

38.Triangulation method

39.Stellar parallax (or parallax method)

40.Parallax angle

41.Arc second

42.Apparent brightness (units?)

43.Solar constant (units?)

44.Luminosity (units?)

45.Perfect Black body

Part 2. Below are the equations from the IB physics data booklet. Define each variable and draw a detailed image for each equation. Write neatly. Explain the equation in words and images.

1. $d(parsec) = \frac{1}{p(arc-second)}$

2. $L = \sigma A T^4$

3. $b = \frac{L}{4\pi d^2}$

Name: _____

Due Date: _____

D2 Stellar Characteristics and Stellar Evolution

Understandings:

- Stellar spectra
- Hertzsprung-Russell (HR) diagram
- Mass-luminosity relation for main sequence stars
- Cepheid variables
- Stellar evolution on HR diagrams
- Red giants, white dwarfs, neutron stars, and black holes
- Chandrasekhar and Oppenheimer-Volkoff limits

Equations

$\lambda_{max}T = 2.9 \times 10^{-3}\ mK$

$L \propto M^{3.5}$

Part 1: Define the following terms. Write neatly. Draw a detailed image if you have to.

The solutions can be found on the YouTube channel Go Physics Go:

https://www.youtube.com/@gophysicsgo/playlists

1. Wien's displacement law

2. Only Bad Astronomers Forget Generally Known Mnemonics

3. Absorption spectrum

4. Main sequence stars

5. Hertzsprung-Russell diagram

6. Spectroscopic parallax

7. Instability strip

8. Cepheid variables

9. Period-luminosity relationship

10. Standard candles

11. Red giant

12. Red supergiant

13.Planetary nebulae

14.Dwarf star

15.Electron degeneracy pressure

16.White dwarf

17.Supernova

18.Neutron star

19.Neutron degeneracy pressure

20.Black hole

21.Chandrasekhar limit

22.Oppenheimer-Volkoff limit

23.Evolutionary path

Part 2. Below are the equations from the IB physics data booklet. Define each variable and draw a detailed image for each equation. Write neatly. Explain the equation in words and images.

1. $\lambda_{max}T = 2.9 \times 10^{-3}\ mK$

2. $L \propto M^{3.5}$

Name: _____

Due Date: _____

D3 Cosmology

Understandings:

- The big bang model
- Cosmic microwave background (CMB) radiation
- Hubble's law
- The accelerating universe and redshift (z)
- The cosmic scale factor (R)

Equations

$$z = \frac{\Delta\lambda}{\lambda_0} \approx \frac{v}{c}$$

$$z = \frac{R}{R_0} - 1$$

$$v = H_0 d$$

$$T \approx \frac{1}{H_0}$$

Define the following terms. Write neatly. Draw a detailed image if you have to.

The solutions can be found on the YouTube channel Go Physics Go:

https://www.youtube.com/@gophysicsgo/playlists

1. Cosmology:

2. Olber's paradox:

3. Big bang model:

4. Expanding universe:

5. Red shift:

6. Blue shift:

7. Recession speed:

8. Hubble’s law:

9. Hubble’s constant:

10. Occam’s razor:

11. Hubble time:

12.Cosmic microwave background radiation:

13.Observable/visible universe:

14.Rate of expansion of the universe:

15.Dark energy:

16.Cosmic scale factor *R*:

Name: _____

Due Date: _____

D4 Stellar Processes

Understandings:

- The Jeans criterion
- Nuclear fusion
- Nucleosynthesis off the main sequence
- Type Ia and II supernovae

Define the following terms. Write neatly. Draw a detailed image if you have to.

The solutions can be found on the YouTube channel Go Physics Go:

https://www.youtube.com/@gophysicsgo/playlists

1. Interstellar medium
   https://www.coursehero.com/study-guides/astronomy/the-interstellar-medium/

2. Jeans criterion and Jeans mass M_J

3. Proton-proton cycle:
   http://cseligman.com/text/sun/ppcycle.htm

4. Time for a main sequence star:

5. Lifetime of the Sun:

6. Nucleosynthesis
   https://i1.wp.com/astronomicca.com/wp-content/uploads/2019/06/nucleosynthesis.png?fit=1018%2C1024&ssl=1

7. Neutron capture

8. S-process

9. R-process

10.Supernovae

11.Type Ia supernovae

12.Type II supernovae

Name: _____

Due Date: _____

D5 Further Cosmology

Understandings:

- The cosmological principle
- Rotation curves and the mass of galaxies
- Dark matter
- Fluctuations in the CMB
- The cosmological origin of redshift
- Critical density
- Dark energy

Equations

$$v = \sqrt{\frac{4\pi G}{3}} r$$

$$\rho_c = \frac{3H^2}{8\pi G}$$

Define the following terms. Write neatly. Draw a detailed image if you have to.

The solutions can be found on the YouTube channel Go Physics Go:

https://www.youtube.com/@gophysicsgo/playlists

1. Cosmological principal

2. Homogeneous

3. Isotropic

4. Isotropy

5. Doppler effect

6. Cosmological red-shift

7. Cosmological blue-shift

8. Gravitational red-shift

9. Critical density ρ_c

10.Speed of a star close to the center of a galaxy

11.Speed of a star far from the center of a galaxy:

12. Differences in theoretical and actual values

13. Dark matter and dark energy

a. MACHOs:

b. WIMPs:

c. Neutrinos

14. Possible future for the universe
https://www.physicsoftheuniverse.com/images/glossary_critical_density.jpg

15.Dark energy

16.Fluctuations in the CMB

17.Linking average universe temperature to the cosmological scale factor

18. CMB missions
    a. COBE

    b. WMAP

    c. Planck mission

    d. JWST

19. Age of the universe

20. Makeup of the universe

21. Value of the Hubble Constant