Physics 90 Exam for Unit 1 — SOLUTION

February 28, 2020

Coordinates

1. Latitude

The latitude of the north pole is: (B) +90º

2. Longitude

The longitude of the Greenwich Royal Observatory in England is: (B) 0º

3. Polaris

The declination of Polaris (The North Star) is about: (B) +90º

4. Looking Straight Up

If you are out at night in Pucon, Chile, which has latitude -39º, and you look straight up, you will see stars with declination: (B) -39º

5. Right Ascension

Right ascension is measured with a sidereal clock which:
(C) Needs to run a little fast, because the stars get four minutes ahead of the Sun each day.

6. The "First Point of Aries"

The "First Point of Aries" has moved in the greater than 2000 years since Hipparchus set the system up. Today, the "First Point of Aries" is in: (C) Pisces

7. Right Ascension

If you look through a slit in the roof and something with Right Ascension 13h goes across it, and you keep still and looking through the slit whatever comes into view after one hour has: (C) Right Ascension of 14h

8. The Ecliptic and The Seasons

Some college students decide to meet each year after graduation on a day when the day and night are the same length. They could choose: (A) The Fall Equinox, September 22

Apparent Magnitude (or just "Magnitude")

In the modern magnitude system, Vega has magnitude 0. If the brightness of star 1 is B_1 and the brightness of star 2 is B_2, and the magnitudes are m_1 and m_2, then

$$\frac{B_1}{B_2} = 100^{(m_2 - m_1)/5}$$

Also, since $100^{1/5}$ is about 2.5, we sometimes approximate and say each step (e.g., $1 \rightarrow 2$ or $15 \rightarrow 16$) is a factor of 2.5 dimmer.

9. Apparent Magnitude

In the modern magnitude system, three steps would be about: (C) 16 times dimmer (that's 2.5 * 2.5 * 2.5)

10. Apparent Magnitude

Betelgeuse is sometimes magnitude 0 (the same as Vega). Today it has magnitude 1.5. This represents: (B) a dimming by a factor of $100^{1.5/5}$ which is about 4.

Frequency, Period, Waves

11. Frequency and Period

The high pressure rotor on the world's most powerful turbofan jet engine turns at 9000 rpm. Convert that to Hertz: (C) 150 Hz

12. Frequency and Period

What period corresponds to 100 Hz? (D) 10 ms

13. Frequency from Wavelength

Microwaves ovens have wavelength 12 cm. Their frequency is: (B) 2.5 GHz

14. Wavelength from Frequency

X-rays have frequency ranging from 3×10^{16} Hz to 3×10^{19} Hz. Let's choose something from the middle of the range: $f = 3 \times 10^{17}$ Hz. What wavelength do these waves have? (A) 1 nm

Temperature and Color

15. The Celsius scale

The Celsius scale was chosen so that (A) Water freezes at 0°C and boils at 100°C.

16. The Kelvin scale

On the Kelvin scale, the temperature at which all motion stops is: (A) 0K

17. Temperature Scales

The temperature of Rigel is 11000 K. Convert to Celsius, and then convert to Fahrenheit. The temperature of Rigel in Fahrenheit is: (B) 19341 °F

18. Temperature and Color

Study the dashed curve for the 4000K star. The peak wavelength for such a star is about: (C) 700 nm (C) 700 nm. *Such a star looks reddish and an example is Betelgeuse which has temperature 3500K.*

19. Temperature and Color

If a star produces about equal amounts of all three primary colors — blue, green and red — all three kinds of cones in your eye would be excited equally, and the star would appear: (B) white

20. Wien's Law

There is a star in the Great Square of Pegasus that is just known as HR 8799. This star has temperature 7250 K. Use the formula above and your calculator to find the peak wavelength of this star: (D) 400 nm, which is violet