# Physics 90 Final Exam — SOLUTION

May 18, 2020

## 1. Latitude

(D) -90°

## 2. Declination

180° isn't a valid declination. +90° and -90° are the celestial north and south pole. So it must be that Orion's Belt is (C) 0°.

## 3. Right Ascension

(C) Right ascension is measured with a sidereal clock which is set to 0h when ___The First Point of Aries__ passes across the observing slit.

## 4. Right Ascension

(C) 9h

## 5. Apparent Magnitude

(B) 6.3 times brighter

## 6. Apparent Magnitude

(B) Sirius has magnitude -1.46. This is ____brighter_____ than a magnitude 0 star by a factor of _____$100^{1.46/5}$_____.

## 7. Frequency and Period

(D) $10^{-9}$ seconds

## 8. Frequency from Wavelength

(A) $3 \times 10^{11}$Hz

## 9. The Kelvin scale

(C) 373K

## 10. Temperature Scales

(B) 10,000 °F

## 11. Temperature and Wavelength

(A) $10^6$ nm (which is $10^3 \mu$m or 1mm)

## 12. Temperature and Color

(B) white

## 13. Moon's Phases

The phase numbered 1 is: (A) New Moon

## 14. Moon's Phases

The phase numbered 5 is: (A) Full Moon

## 15. Moon's Phases

(A) The bright side is on the **right**, and the bright side is facing **West** where the Sun went down.

## 16. Prograde and Retrograde Motion

(B) **retrograde** motion, and Mars will be going **westward** through the stars.

## 17. Black Rock Desert Model

(B) grape (he used a blue marble) https://youtu.be/zR3Igc3Rhfg

## 18. Kepler's 3rd Law

(D) All of the above.

## 19. Circular Acceleration

(C) half the acceleration of Star A

## 20. Newton's Universal Law of Gravitation, Space Station

(B) the ISS is falling in a circle around the Earth and the ISS, Chris Hadfield, and his guitar are all in free fall together (one of the few problems I re-used with no wording change because I am really trying to emphasize it)

## 21. Newton's Universal Law of Gravitation, Proportional Reasoning

(D) one-quarter the force of Star A

## 22. Mass and Density of the Planets

(C) The rocky planets have densities approximately ___about five times___ the density of water (1000 $kg/m^3$).

## 23. Intensity

(A) 100 Watts

## 24. Fission and Fusion

It was unclear whether I was asking for what is produced or consumed, so we will take both A and B:
BOTH GOOD (A) Hydrogen, consumed
BOTH GOOD (B) Helium, produced

## 25. Ivy Mike Fusion Bomb and $E = mc^2$

(A) 500g (answer is 0.5kg, but you need to convert to grams to figure out the correct choice)

## 26. The Structure of the Sun

(A) The heat coming up through a poker rod if the tip of the poker is in the fireplace.

## 27. Parallax

The A.U. is about (E) 3 light-years

## 28. Parallax

(C) 8 parsecs away (because 1/0.125 = 8)

## 29. Inverse Square Law for Light

(D) 1/16 the intensity of Star 2

## 30. Inverse Square Law for Light

(D) 100 times dimmer

## 31. Absolute Magnitude

(C) 7

## 32. HR Diagrams

(C) +2.5

## 33. HR Diagrams

(A) the main sequence

## 34. Period-Luminosity Relationship

(A) 11.3

## 35. Period-Luminosity Relationship

(B) 12.5

## 36. Distance from Absolute Magnitude

This one is hard, you have to figure out how much change in distance results in 19 magnitudes. It's $\sqrt{100^{19/5}}$=6309. Then you have to multiply that by the standard distance of 10 parsecs. The closest answer is (B) 60,000 parsecs

## 37. Apparent Magnitude from Distance

10 times as far is another 100 times dimmer which is five mags dimmer, so it would be apparent mag 17 (C) 17.

## 38. The Doppler Effect

(D) Stars coming toward us have their spectra ___blue-shifted_____, stars going away have their spectra _____red-shifted____, and stars going perpendicularly have their spectra ____unaffected_____.

## 39. The Big Bang

(D) Hubble's 1929 paper predicted a Big Bang. In 1964, some scientists setting up a microwave receiver observed _____heavily red-shifted_____ light from the Big Bang. This light had been traveling toward their receiver for _____billions_____ of years

## 40. Galactic Rotation Curves

(A) You'd expect that stars closer than our Sun to the center of the galaxy would be going ____faster_____, and stars further than our Sun would be going ____slower___, but in the real data they are all ___going about the same speed as the Sun_____.