

Physics Department

Physics 200  
Final Exam

February 8, 1999  
Time: 1 1/2 hours

Name: \_\_\_\_\_

I.D No.: \_\_\_\_\_

*cross the name of your instructor:*

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Information:

- No make up for this exam without legal reason.
- Only one answer is valid in multiple choice questions.
- Physical constants: *the speed of light is  $c=3 \times 10^8$  m/s*  
*Planck constant  $h = 6.626 \times 10^{-27}$  erg.s*

Page                      Grade

(1)

(2)

(3)

(4)

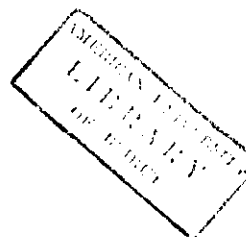
(5)

(6)

(7)

(8)

\_\_\_\_\_  
TOTAL:



**TRUE OR FALSE**

- |  | <u>True</u>              | <u>False</u>             |
|--|--------------------------|--------------------------|
| • The time interval from full moon to full moon is the moon sidereal period.   | <input type="checkbox"/> | <input type="checkbox"/> |
| • If the moon were at twice its current distance, eclipses would occur more frequently.                              | <input type="checkbox"/> | <input type="checkbox"/> |
| • The occasion when the sun crosses the celestial equator is called equinox.   | <input type="checkbox"/> | <input type="checkbox"/> |
| • Kepler's first law tells us that planets moves in circular orbits with the sun at the center.                      | <input type="checkbox"/> | <input type="checkbox"/> |
| • The center of mass of the Earth-moon system is closer to the moon than the earth.                                  | <input type="checkbox"/> | <input type="checkbox"/> |
| • If body A weighs twice as much as body B, the gravitational force on A is half that on B.                          | <input type="checkbox"/> | <input type="checkbox"/> |
| • Blue light travels faster than red light.  | <input type="checkbox"/> | <input type="checkbox"/> |
| • The type of electromagnetic wave which is adjacent to visible light but at higher energy is ultraviolet radiation. | <input type="checkbox"/> | <input type="checkbox"/> |
| • A 5 inch diameter telescope will collect 10 times more light than a 1 inch diameter telescope.                     | <input type="checkbox"/> | <input type="checkbox"/> |
| • The release of heat from the Earth's hot core is the major source of heat to the Earth's surface.                  | <input type="checkbox"/> | <input type="checkbox"/> |
| • The Earth's magnetic field shields the Earth from high energy charged particles.                                   | <input type="checkbox"/> | <input type="checkbox"/> |
| • Photons created by the proton-proton reaction travel immediately to the surface of the sun.                        | <input type="checkbox"/> | <input type="checkbox"/> |

- Energy transport in the sun is accomplished by radiation only.
- The sun is stable because of an equilibrium between the forces of gravity and the magnetic force.
- High temperature are required for fusion to occur because of electrostatic repulsion between the reacting nuclei.
- Different stars show different spectra only because of variations in their chemical composition.
- A sixth magnitude star is 100 times brighter than a first magnitude star.
- A star with a parallax of 0.5 degrees of arc is two Parsec away.
- Red supergiant stars are considerably cooler than red giant stars.
- An H-R diagram is a graph with mass plotted against luminosity.
- Asteroid A orbits the sun at a distance of 4 AU while asteroid, B, being one-half as larger as A, orbits at 8 AU. Which asteroid will take longer to go around the sun according to Kepler's law?  
 (a) asteroid A.  
 (b) asteroid B.  
 (c) neither, both will take the same time.
- The ability to distinguish between details or to distinguish to adjacent objects as separate is:  
 a) reflection  
 b) refraction  
 c) aperture  
 d) resolution  
 e) spectroscopy

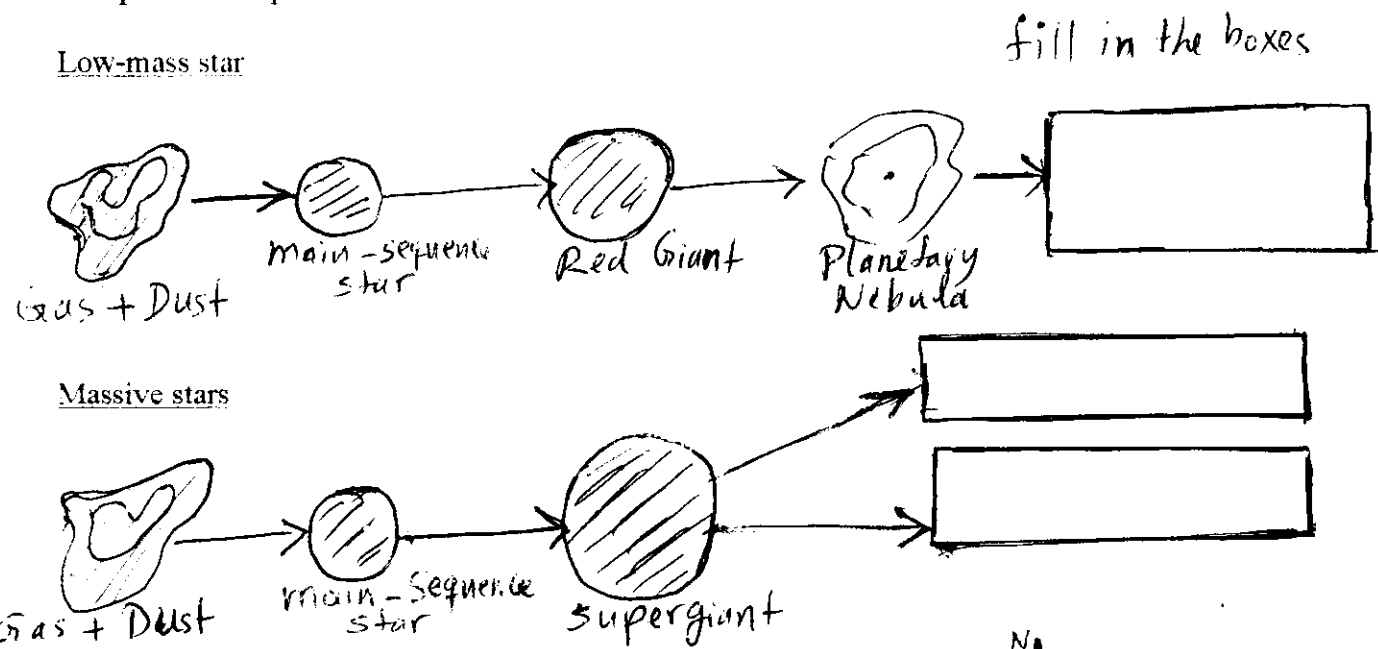
- When light of different wavelengths is brought to a focus by a lens the color that will be focused nearest to the lens is
  - a) red      b) orange      c) yellow      d) green      e) blue
  
- The distance from which one astronomical unit subtends only one second of arc is one:
  - a) Astronomical unit
  - b) Light second
  - c) Light year
  - d) Hubble constant
  - e) Parsec.
  
- The total amount of energy a star gives off each second is its:
  - a) absolute magnitude
  - b) apparent magnitude
  - c) luminosity
  - d) bolometric magnitude
  - e) none of the above
  
- A star that is 40 parsecs from the sun would, if moved to a distance of 10 parsecs, be
  - a) 4 times brighter
  - b) 4 times dimmer
  - c) 16 times brighter
  - d) 16 times dimmer
  - e) none of the above
  
- Relative to a solar day, a sidereal day is:
  - a) four minutes longer
  - b) four minutes length.
  - c) The same length
  - d) Constantly changing
  - e) None of the above
  
- When planets drift backward with respect to the stars, the motion is called:
  - a) Retrograde
  - b) Wandering
  - c) Prograde
  - d) Reverse

- The distribution of the intensity of a star's radiation by wavelength depends on the star's surface:
  - a) color
  - b) density
  - c) pressure
  - d) temperature
  - e) x-rays.
  
- If star 1 has a spectrum that peaks in the red and star 2 has a spectrum that peaks in the blue (assume that red light has a wavelength 50% greater than blue light), the ratio of star 2's surface temperature over that of star 1's is approximately
  - a) one-half
  - b) two
  - c) one-quarter
  - d) four
  - e) none of the above
  
- A full rainbow of colors given off by a hot source (suppose a star) is called?
  - a) Absorption spectrum
  - b) Emission spectrum
  - c) Fraunhofer spectrum
  - d) Continuous spectrum
  - e) None of the above
  
- Comparing a single photon with a wavelength of 600 nanometer to one with a wavelength of 200 nanometer, the energy of the 600 nanometer photon will be?
  - a) 3 times larger
  - b) 6 times less
  - c)  $\frac{1}{3}$  less
  - d)  $\frac{1}{9}$  less
  - e) none of the above my answer is: \_\_\_\_\_
  
- Stars appearing red in color are probably type:
  - a) B
  - b) A
  - c) F
  - d) M
  - e) O

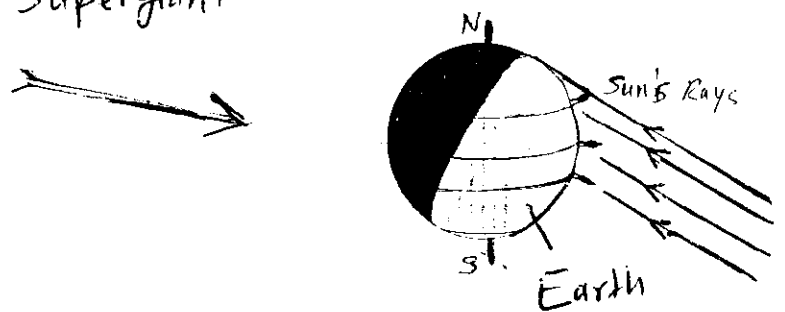
- Supernovae produced in binary systems by matter falling on white dwarf stars are:

- Type I.
- Type II.
- Unknown type

- The figure below shows in a schematic way evolutionary sequences for low-mass stars and massive stars. The end stages are missing as indicated by question marks. Complete the sequences.

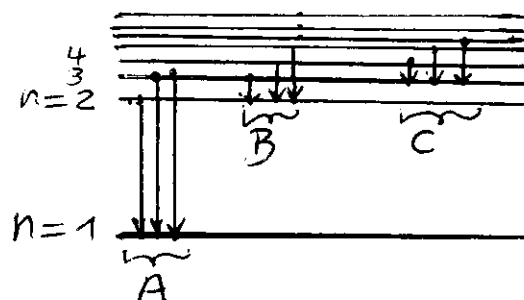


- What time of the year does the Figure on the right represent in the northern hemisphere?
- vernal equinox
  - winter solstice
  - spring solstice
  - summer solstice



- In the figure below, the energy level diagram of the hydrogen atom is shown schematically. Which transitions lead to emission of ultraviolet light?

A                      B                      C



- The wavelength of a photon emitted from a hydrogen atom in this transition from the energy level  $n = 3$  (energy =  $1.94 \times 10^{-11}$  erg) to the level  $n = 2$  (energy =  $1.63 \times 10^{-11}$  erg) is about:
 

a) 6200 Å    b) 6800 Å    c) 6400 Å    d) 7000 Å
- In the laboratory, one finds a certain line of sodium at wavelength  $\lambda_0 = 5890 \text{ \AA}$ . In a spectrum of a star this wavelength is measured as  $\lambda = 5892 \text{ \AA}$ 

a) At what velocity is the star moving?  
 Answer: \_\_\_\_\_ km/h

b) In which direction is the star moving?  
 (a) toward the Earth    (b) away from the Earth
- The table below gives some properties of the stars included. Answer the following questions:

Star	Absolute Magnitude (M)	Apparent Magnitude (m)	Spectral type	Luminosity Class
Spica	-3.5	+1.0	B	III
Deneb	-7.2	+1.3	A	Ia
Vega	+0.50	-0.06	A	V
Mirfac	-2.2	1.79	F	Ib
Betelgeouse	-7.0	+0.50	M	Ia

- a) Which star has the greatest apparent brightness? \_\_\_\_\_

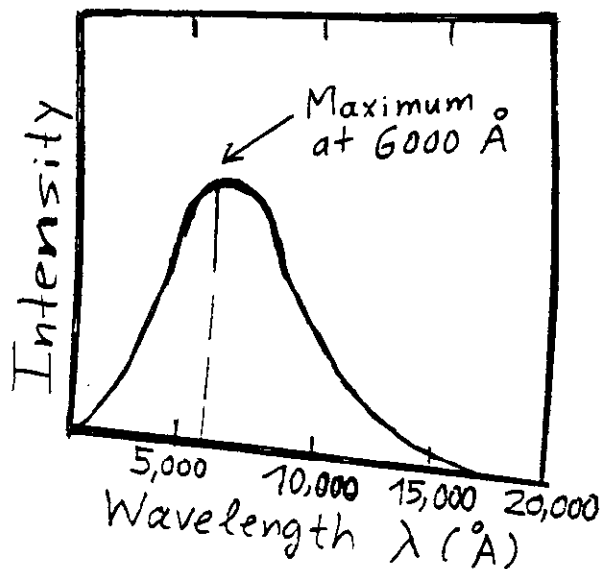
b) Which star is intrinsically the brightest? \_\_\_\_\_

c) Which star has the highest surface temperature? \_\_\_\_\_

d) Which star has the lowest surface temperature? \_\_\_\_\_

e) Which star is a red-supergiant? \_\_\_\_\_

f) Which star is a main-sequence stars? \_\_\_\_\_
- The figure on the right, shows a Planck curve of unknown temperature.



- a) If a star emits radiation as black body with this curve, how would the color of the star look like?  
 a) red    b) white    c) blue    d) yellow

b) The temperature of the star would be:  
 Answer: \_\_\_\_\_ Kelvin

- How many times is a second-magnitude star brighter than a 12<sup>th</sup>-magnitude star?

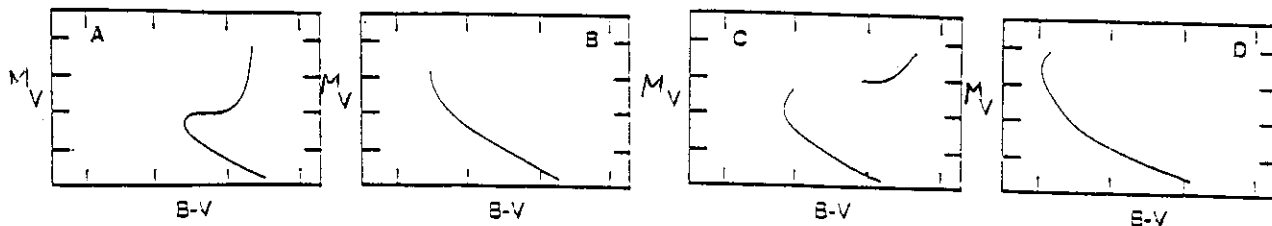
$2.5 \times 10^5$

$10^5$

$10^4$

$10^3$

- The diagrams below represent in a schematic way four star clusters



- a) Which cluster is most likely the oldest?

A

B

C

D

- b) Which cluster is most likely the youngest?

A

B

C

D

- c) Which cluster contains most likely RR Lyrae variables?

A

B

C

D

- If a new object is discovered in the solar system with an orbital period of 25 earth years, its average distance from Earth would be (in AU) :

29.2

25

9.6

8.6

62

- Using the schematic Hertzsprung-Russell diagram  
Shown on the right, answer the following questions:

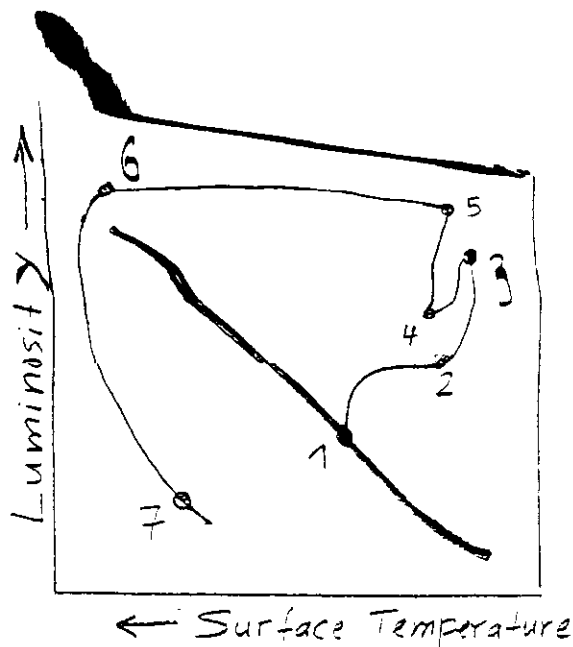
a) This track represents the evolution of:

low-mass star

massive star

- b) The point indicated by (e) represent an evolutionary phase called:

Answer: \_\_\_\_\_





- How many times is a second-magnitude star brighter than a 12<sup>th</sup>-magnitude star?

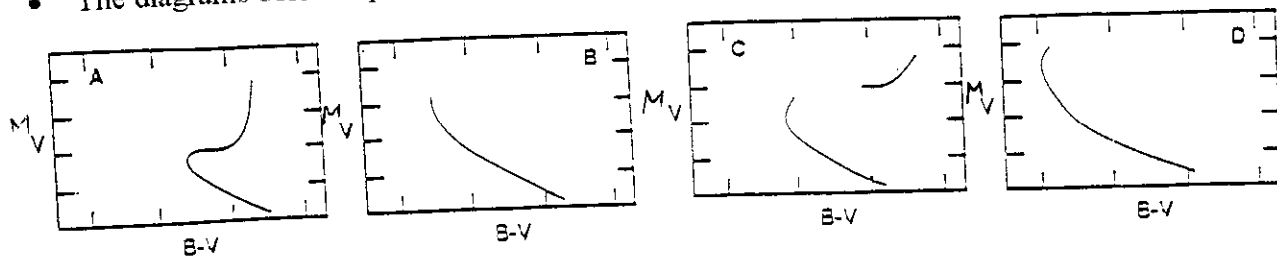
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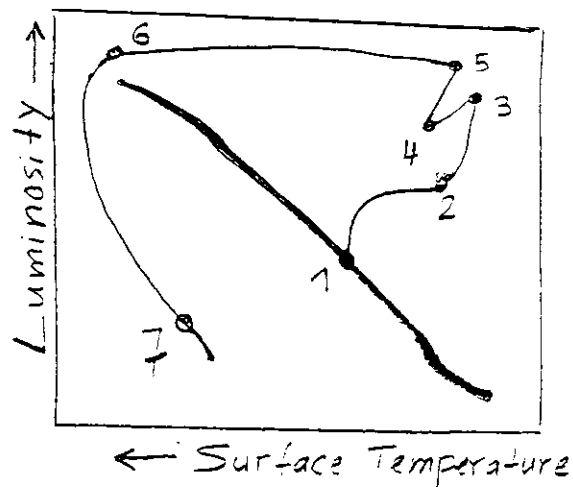
- a) This track represents the evolution of:

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Answer: \_\_\_\_\_



- The distance modulus of a star at a distance of 10 PC is:

-4.0     +4.0     -10.0     -10.0     0.0

- A star at a distance of 100 PC has an apparent magnitude of +10. What is the absolute magnitude of this star?

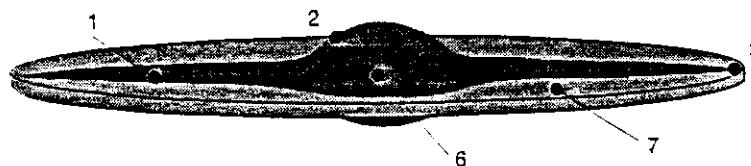
+20     +10     -5     +5     -10

- Which spectral type has the highest positive color index?

- O-type stars, since they have the highest temperature
- G-type stars, since they are like the sun
- Any spectral type, since this a question of the metallicity of the star
- M-type stars, because they have the lowest temperatures

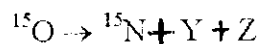
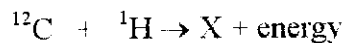
- The graph below a schematic structure of the Milky Way. What number best represent the location of the sun?

Answer: \_\_\_\_\_



The Milky Way  
OUR HOME

- Given are the following nuclear reactions:



Answers:

X: \_\_\_\_\_

Y: \_\_\_\_\_

Z: \_\_\_\_\_

Choose X, Y and Z from the following list

- a)  $^4\text{He}$     b)  $^{14}\text{N}$     c)  $^3\text{He}$     d)  $^{13}\text{N}$     e) Neutrino  
f)  $^{13}\text{C}$     g) Positron

- How many protons are consumed in the CNO cycle?

a) none    b) 2    c) 4    d) 3