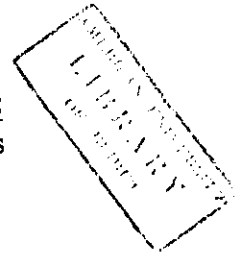


Physics Department

Physics 200  
Final Exam

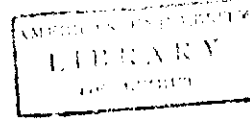
February 5, 1998  
Time: 1 1/2 hours



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

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

Information



- No make up of this exam without legal reason
- In case of multiple choice questions, more than one answer will cancel the whole question.
- All questions are obligatory.
- Whenever you need the speed of light, it is :  $3 \times 10^8$  m/s.

Page \_\_\_\_\_ Grade

- (1) .....
- (2) .....
- (3) .....
- (4) .....
- (5) .....
- (6) .....
- (7) .....
- (8) .....



- If the light needs 4.0 light years to reach us from a certain star, how far is this star from us in km?

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

- Comparing the sidereal day to the solar day, I should say:
  - they are the same
  - the sidereal day is longer than a solar day
  - the sidereal day is shorter than a solar day
  - the sidereal day is the time for the Earth to rotate once about its axis with respect to stars
  - C and D are true.

- Which calendar describes more correctly the time for the Earth to orbit the sun?

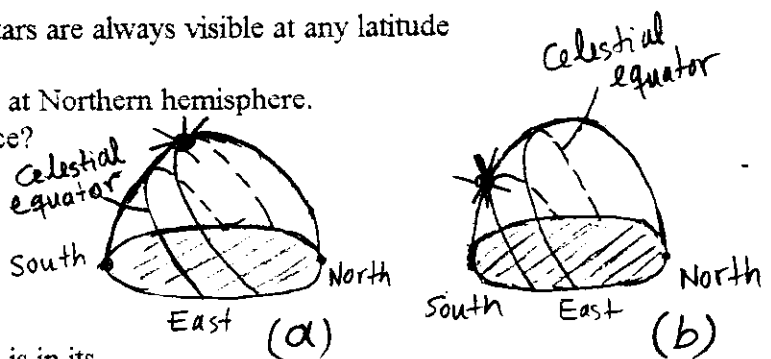
Julian calendar                       Gregorian calendar

- If stars should be always visible, where should you be located on Earth?

Equator                       North or South poles  
 no where is this possible                       stars are always visible at any latitude

- The figures below show the noontime sun at Northern hemisphere. Which figure corresponds to winter solstice?

a     b     none of them



- Lunar eclipse occurs only when the moon is in its

new phase     quarter phase     full phase     crescent phase

- As you look to the south from the northern hemisphere, the stars appear to move:

to your left     to your right     perpendicular to the horizon

- The inequality of the seasons ( for example summer has a different length from winter) is a consequence of which Kepler's law:

first law     second law     third law     has nothing to do with Kepler's laws

- If an object is discovered that has an orbital period of 14.70 years, what is the semi-major axis of its orbit about the sun? (AU = Astronomical unit)

3.0 AU     1.5 AU     6.0 AU     9.0 AU

- If you could double the mass of the Earth, but keep its radius the same, you will be attracted to the Earth's center by force that is:

the same       four times larger       twice larger       eight times larger

- What is the wavelength of a 100 MHz ( MHz = Mega Hertz) radio signal?

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

- An object A has a black body emission spectrum that peaks (has a maximum) at a wavelength of  $2 \times 10^{-5}$  cm. Another object B has a spectrum that peaks at  $5.8 \times 10^{-5}$  cm.

(a) which object is hotter?  A       B

(b) the temperature of object A is :

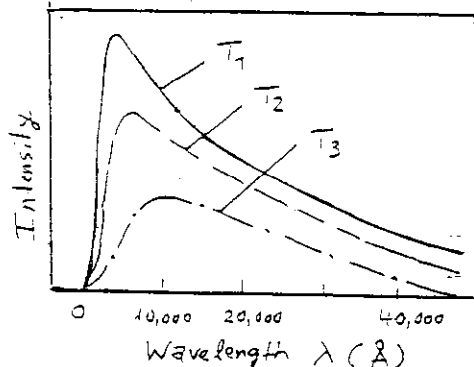
3800 K       4000 K       5000 K       not possible to obtain from these information

- In the figure below, the spectrum of a blackbody is shown for three temperatures  $T_1$ ,  $T_2$  and  $T_3$

(a) Which of the following is true?

$T_1 = T_2 = T_3$         $T_1 < T_2 < T_3$

$T_1 > T_2 > T_3$        temperature cannot be uniquely defined in this case



(b) If the total emitted energy  $E_3 = 10^4 E_2$ , what is the ratio  $T_3/T_2$  ?

100       10       1.0       1000

- An element X is radioactive and decays into other element Y with a half life of 100 days. At beginning there are 200 g of element X and nothing of element Y. How many days will it take to obtain 175 g of element Y?

175       200       325       300

- Sunspots have lifetimes of about:

22 years       11 years       2 years       10 days

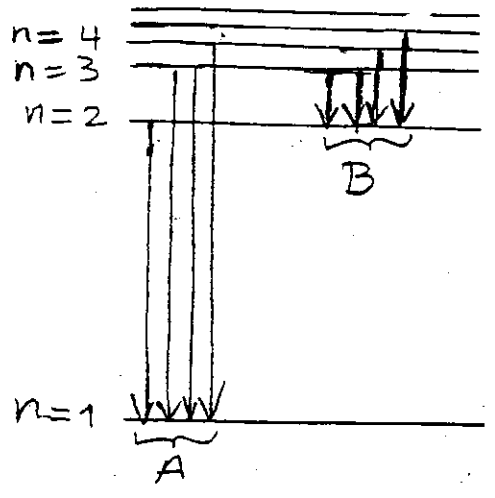
• In the figure below, the energy level diagram of the hydrogen atom is shown in a schematic way. (not complete)

(a) which transitions lead to emission of invisible light.

A       B

(b) Is it possible to ionize the hydrogen atom with light of wavelength in the visible range?

yes       No



• In the figure at the right the initial and final states of the hydrogen atom are shown (not to scale).

(a) which final state corresponds to ionization? (circle one)

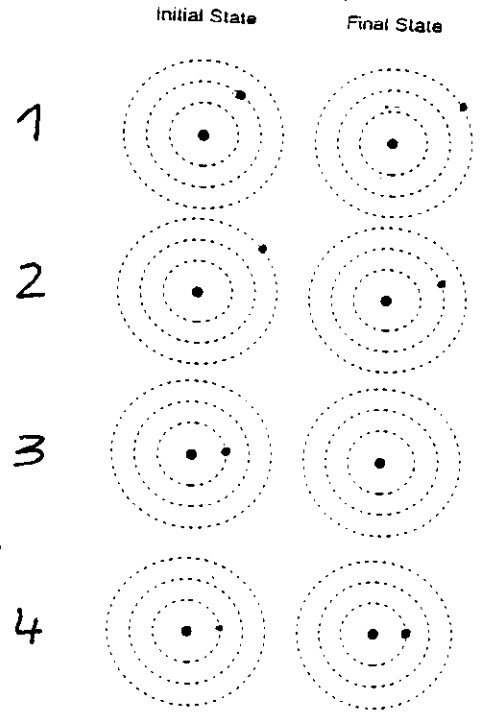
1      2      3      4

(b) which final state corresponds to emission of light?

1      2      3      4

(c) which final state corresponds to absorption of light?

1      2      3      4



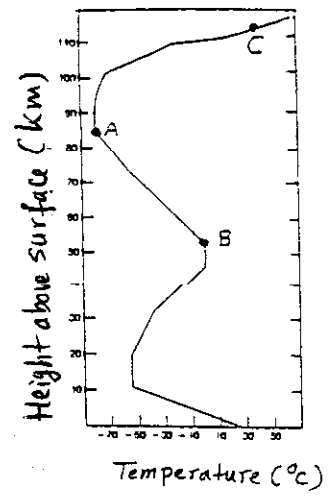
• The figure on the right shows the height of the Earth's atmosphere against the temperature.

(a) why does the temperature increase along the part A to C?

Answer:

(b) why the increase of the temperature along the part A to B?

Answer:



- In the northern hemisphere surface winds are deflected toward the right because:

- the Earth's core is partially molten
- the continents are drifting
- the Earth rotates rapidly
- the Oceans control the wind directions

- Which of the following nuclear reaction occurring in the core of the sun is correct:

- ${}^3\text{He} + {}^3\text{He} \rightarrow {}^6\text{Be} + \gamma$
- ${}^3\text{He} + {}^3\text{He} \rightarrow {}^3\text{He} + 3 {}^1\text{H}$
- ${}^3\text{He} + {}^3\text{He} \rightarrow {}^4\text{He} + 2 {}^1\text{H}$
- ${}^3\text{He} + {}^3\text{He} \rightarrow {}^5\text{He} + {}^1\text{H}$

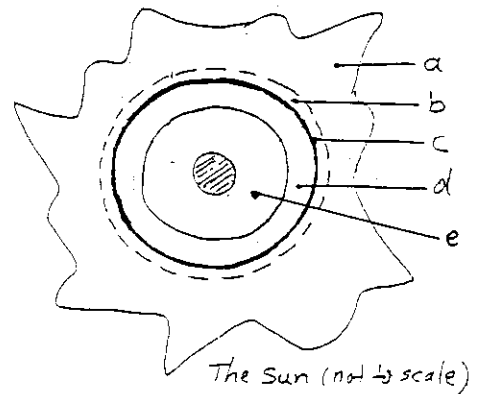
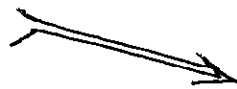
- In the figure on the right, a schematic picture of the sun is shown. Answer the following questions:

(a) Identify the convective zone (circle one letter):

a      b      c      d      e

(b) Identify the photosphere (circle one letter):

a      b      c      d      e



- The solar constant is  $1.4 \times 10^6 \frac{\text{erg}}{\text{cm}^2 \cdot \text{s}}$ . Suppose you measure the solar constant at the location of Jupiter, that is 5 AU away from the sun. By what factor would the solar constant decrease?

- 5                   10                   25                   50

- The sun gets its energy supply from:

- Slow contraction
- Nuclear fusion of oxygen in the core
- Nuclear fusion of hydrogen in the core
- from the motion of convective material

- What kind of particle leaves the sun without interaction?

photon       electron       neutrino       proton

- The stellar spectral sequence from hottest to coolest is:

OFGKMGB       AFGKMO       OBAFGKM       OBAFGMK

- A first magnitude star is how many times brighter than an eleventh magnitude star?

10       50       100       1,000       10,000

- A star has a distance of 10 parsecs. What is its parallax?

10 minutes of arc       10 seconds of arc       0.1 seconds of arc       0.01 seconds of arc

- A star has a radial velocity of 30 km/s and a tangential velocity of 40 km/s. The space velocity (proper motion) of this star is :

10 km/s       20 km/s       25 km/s       50 km/s

- At what radial velocity would a spacecraft have to be moving for a radio station transmitting at 100 MHz (  $10^8$  Hertz) to be picked up by a radio tuned to 99.9 MHz?

6 00 km/s       3 00 km/s       -3 00 km/s       9 00 km/s

- A star A has a color index  $B-V = 0$ , another star B has a color index  $+ 0.50$ . Which star is hotter?

A       B

- Mention three possible end stages of stellar evolution:

1. \_\_\_\_\_  
2. \_\_\_\_\_  
3. \_\_\_\_\_

- How far is the sun from the galactic center?

10 kpc       500 kpc       8.5 kpc       30 kpc

- The table below gives characteristics of several stars as indicated. On the basis of these data, answer the following questions:

Star Name	Abs Magnitude M	Apparent magnitude m	Spectral type	Luminosity Class
Spica	-3.5	+1.0	B	III
Antares	-3.8	+1.0	M	I
Sirius	+1.4	-1.5	A	V
Rigel	+4.4	0.0	G	V
Deneb	-7.2	+1.3	A	I

- Which star is intrinsically the brightest: \_\_\_\_\_
- Which star has the greatest apparent magnitude: \_\_\_\_\_
- Which star has the greatest surface temperature: \_\_\_\_\_
- Which star is a reddish supergiant: \_\_\_\_\_

- The figure on the right shows a schematic evolutionary sequence of a low-mass star in the Hertzsprung- Russell diagram. Answer the following questions

- where does the hydrogen burning proceed in the star's core?

between points 2 and 3

between points 1 and 2

between points 4 and 5

- Where does the helium burning (helium fusion) starts at the star's center?

1

2

3

4

- At what point in the diagram is the star observed as planetary nebula?

2

3

5

7

8

- What point corresponds to the position of a white dwarf?

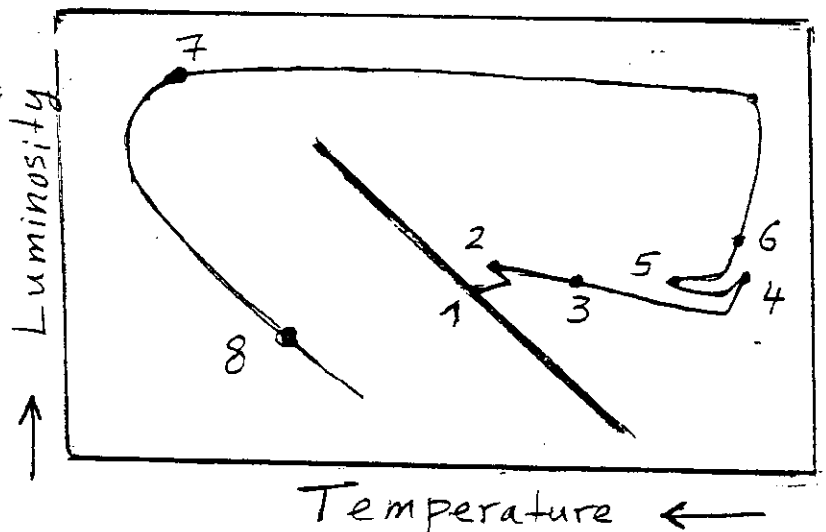
2

3

7

8

6



- Which of the following is true for type II Cepheid variables?

- A. They are low-mass stars
- B. They are giant stars
- C. They have terminated their helium fusion in the core
- D. A, B, C is true
- E. Only A, B is true

- The 21-cm line of the hydrogen atom arises from which of the following?

transition between two energy levels of this atom.

capturing an electron by the hydrogen atom

up to down flip of the electron spin

it is always emitted whenever the hydrogen atom interact with light.

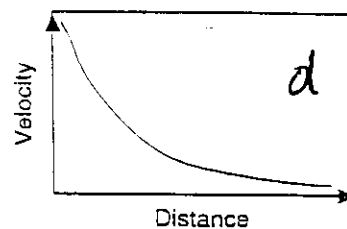
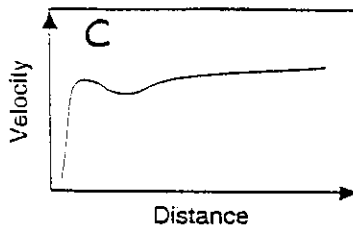
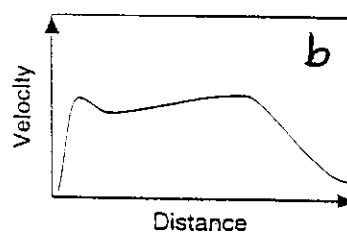
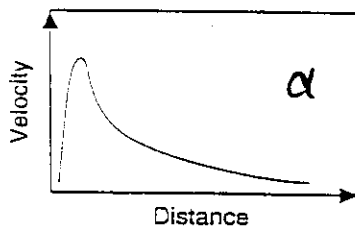
- In the figure below, several velocity-distance curves are shown schematically. Which curve closely represents the correct rotation curve of the Milky way? (circle one letter):

a

b

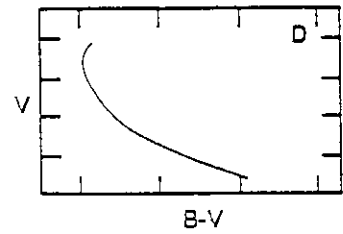
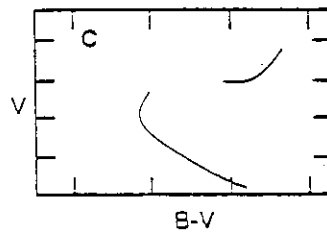
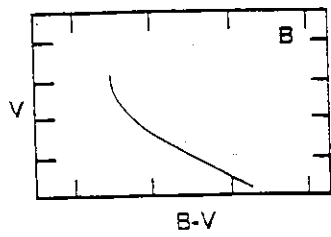
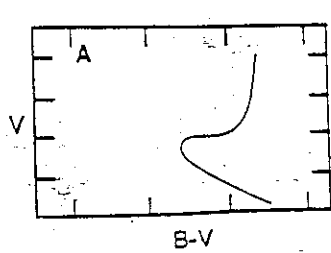
c

d





- The curves in each of the four color-magnitude diagrams represents the location of all stars in a star cluster. Answer the following questions.



(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 is most likely to contain Cepheid variables?

 A

 B

 C

 D