

National Testing Agency

Question Paper Name :	Stars And Stellar Systems 15th Sep 2020 Shift 1
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Stars And Stellar Systems

Group Number :	1
Group Id :	89951420
Group Maximum Duration :	0
Group Minimum Duration :	120
Show Attended Group? :	No
Edit Attended Group? :	No
Break time :	0
Group Marks :	100
Is this Group for Examiner? :	No

Stars And Stellar Systems

Section Id :	89951420
Section Number :	1
Section type :	Online
Mandatory or Optional :	Mandatory
Number of Questions :	4

Number of Questions to be attempted :	4
Section Marks :	100
Display Number Panel :	Yes
Group All Questions :	Yes
Mark As Answered Required? :	Yes
Sub-Section Number :	1
Sub-Section Id :	89951430
Question Shuffling Allowed :	Yes

Question Id : 8995141596 Question Type : COMPREHENSION Sub Question Shuffling Allowed : Yes Group Comprehension Questions : No

Question Numbers : (1 to 25)

Question Label : Comprehension

CONSTANTS AND CONVERSION FACTORS:

Speed of light $c = 3 \times 10^8 \text{ms}^{-1}$

Planck's constant $h = 6.626 \times 10^{-34} \text{J.s}$

Gravitational constant $G = 6.674 \times 10^{-11} \text{m}^3 \text{kg}^{-1} \text{s}^{-2}$

Mass of proton $m_p = 1.673 \times 10^{-27} \text{kg}$

Mass of electron $m_e = 9.109 \times 10^{-31} \text{kg}$

Stefan-Boltzmann constant $\sigma = 5.670 \times 10^{-8} \text{Jm}^{-2} \text{s}^{-1} \text{K}^{-4}$

Boltzmann constant $k = 1.381 \times 10^{-23} \text{JK}^{-1}$

Mass of Sun $M_{\odot} = 1.989 \times 10^{30} \text{kg}$

Luminosity of Sun $L_{\odot} = 3.83 \times 10^{26} \text{W}$

Radius of Sun $R_{\odot} = 6.96 \times 10^8 \text{m}$

Mass of Earth $M_{\oplus} = 5.972 \times 10^{24} \text{kg}$

$$1 \text{eV} = 1.602 \times 10^{-19} \text{J}$$

$1 \text{pc} = 3.26 \text{ly}$; $1 \text{pc} = 3.086 \times 10^{16} \text{m}$; $1 \text{ly} = 9.461 \times 10^{15} \text{m}$

$$1 \text{yr} = 3.154 \times 10^7 \text{s}$$

Sub questions

Question Number : 1 Question Id : 8995141597 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

What are the progenitors of type-Ia supernovae?

- A. 10-15 M_{\odot}
- B. 20-30 M_{\odot}
- C. 2-3 M_{\odot}
- D. 100 M_{\odot}

Options :

- 8995146360. 1
- 8995146361. 2
- 8995146362. 3
- 8995146363. 4

Question Number : 2 Question Id : 8995141598 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Primary elements produced during AGB evolution are

- A. C, N, O and s-process
- B. Fe-peak and Mg, Si
- C. Mg, Si and r-process
- D. Ca, Ti, Eu

Options :

- 8995146364. 1
- 8995146365. 2
- 8995146366. 3
- 8995146367. 4

Question Number : 3 Question Id : 8995141599 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

What is Lithium plateau?

- A. The constant Lithium abundances derived from cosmic baryon density based on CMB measurement
- B. Lithium observed in the interstellar medium
- C. Lithium observed in metal poor halo dwarfs
- D. Lithium that is made in cosmic ray spallation

Options :

- 8995146368. 1
- 8995146369. 2
- 8995146370. 3
- 8995146371. 4

Question Number : 4 Question Id : 8995141600 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

Typical mass of the Giant Molecular Cloud is

- A. about $10 M_{\odot}$
- B. about $100 M_{\odot}$
- C. few $100 M_{\odot}$
- D. greater than $1000 M_{\odot}$

Options :

- 8995146372. 1
- 8995146373. 2
- 8995146374. 3
- 8995146375. 4

Question Number : 5 Question Id : 8995141601 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Our Sun has already spent about _____ of its nuclear burning lifetime.

- A. 90%
- B. 80%
- C. 50%
- D. 30%

Options :

- 8995146376. 1
- 8995146377. 2
- 8995146378. 3
- 8995146379. 4

Question Number : 6 Question Id : 8995141602 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

For an observer in Australia

- A. north celestial pole is visible in the sky
- B. south celestial pole is visible in the sky
- C. none of the celestial poles are visible in the sky
- D. both the celestial poles are visible on opposite sides of the sky

Options :

- 8995146380. 1
- 8995146381. 2
- 8995146382. 3
- 8995146383. 4

Question Number : 7 Question Id : 8995141603 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

The maximum mass possible for a white dwarf star is

- A. $1.4 M_{\odot}$
- B. $1.0 M_{\odot}$
- C. $0.1 M_{\odot}$
- D. $0.8 M_{\odot}$

Options :

- 8995146384. 1

8995146385.2

8995146386.3

8995146387.4

Question Number : 8 Question Id : 8995141604 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

The stars Betelguese and Rigel are in the constellation of Orion. Betelguese appears red while Rigel appears bluish. This is because

- A. Rigel is farther than Betelguese from us
- B. Rigel is nearer than Betelguese from us
- C. surface of Rigel is hotter than Betelguese
- D. surface of Rigel is cooler than Betelguese

Options :

8995146388.1

8995146389.2

8995146390.3

8995146391.4

Question Number : 9 Question Id : 8995141605 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

Limb darkening in the image of a stellar disc is due to

- A. poor image quality at edges
- B. energy production throughout the star
- C. line-of sight at edge intersects lower temperature regions unlike the centre
- D. star-spots, similar to sunspots

Options :

8995146392. 1

8995146393. 2

8995146394. 3

8995146395. 4

Question Number : 10 Question Id : 8995141606 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

The intermediate element produced in triple alpha reaction is

- A. Li
- B. Be
- C. B
- D. C

Options :

8995146396. 1

8995146397. 2

8995146398.3

8995146399.4

Question Number : 11 Question Id : 8995141607 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Which of the following statements is not true about most brown dwarfs?

- A. Effective temperatures lie between 900 and 3500 K
- B. Very faint low luminosity objects
- C. They have strong winds
- D. Some nuclear fusion occurs in their interiors

Options :

8995146400.1

8995146401.2

8995146402.3

8995146403.4

Question Number : 12 Question Id : 8995141608 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

gamma Doradus variable stars fall on the

- A. main-sequence
- B. horizontal branch
- C. red-giant branch
- D. asymptotic giant branch

Options :

- 8995146404. 1
- 8995146405. 2
- 8995146406. 3
- 8995146407. 4

Question Number : 13 Question Id : 8995141609 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

beta Cephei and SPB stars are located in the

- A. Cepheid instability strip
- B. Delta Scuti instability strip
- C. red-giant branch
- D. main-sequence

Options :

- 8995146408. 1
- 8995146409. 2
- 8995146410. 3
- 8995146411. 4

Question Number : 14 Question Id : 8995141610 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Which variable stars help in constraining lower bound on the age of the Universe?

- A. Type I Cepheids
- B. Type II Cepheids
- C. RR Lyrae variables
- D. Mira variables

Options :

- 8995146412. 1
- 8995146413. 2
- 8995146414. 3
- 8995146415. 4

Question Number : 15 Question Id : 8995141611 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

The distance of the first Lagrange point from Earth is

- A. one hundredth of 1 AU
- B. one tenth of 1 AU
- C. one thousandth of 1 AU
- D. same as 1 AU

Options :

- 8995146416. 1
- 8995146417. 2
- 8995146418. 3

8995146419. 4

Question Number : 16 Question Id : 8995141612 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

The optical emission from the Sun comes from the photosphere, while that seen at low radio frequencies arises in the

- A. photosphere
- B. chromosphere
- C. transition layer
- D. corona

Options :

- 8995146420. 1
- 8995146421. 2
- 8995146422. 3
- 8995146423. 4

Question Number : 17 Question Id : 8995141613 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

Is the current global warming completely due to the Sun's activity?

- A. No
- B. Maybe
- C. Yes
- D. We do not have the understanding to answer this question

Options :

- 8995146424. 1
- 8995146425. 2
- 8995146426. 3
- 8995146427. 4

Question Number : 18 Question Id : 8995141614 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

What is the source of energy for powering solar storms and stellar flares?

- A. Gravitational energy
- B. Nuclear energy
- C. Potential energy
- D. Magnetic energy

Options :

- 8995146428. 1
- 8995146429. 2
- 8995146430. 3
- 8995146431. 4

Question Number : 19 Question Id : 8995141615 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

The Alfvén flux freezing condition

- A. applies to high Reynolds number plasma
- B. applies to situations where the conductivity of the plasma is very small
- C. applies to situations where Alfvén waves propagate
- D. applies to situations where the resistivity is high

Options :

- 8995146432. 1
- 8995146433. 2
- 8995146434. 3
- 8995146435. 4

Question Number : 20 Question Id : 8995141616 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

In a neutron star, what is the density above which superfluid neutrons are expected to be found?

- A. $4 \times 10^{11} \text{ g cm}^{-3}$
- B. $4 \times 10^{12} \text{ g cm}^{-3}$
- C. $4 \times 10^{13} \text{ g cm}^{-3}$
- D. $4 \times 10^{14} \text{ g cm}^{-3}$

Options :

- 8995146436. 1
- 8995146437. 2
- 8995146438. 3
- 8995146439. 4

Question Number : 21 Question Id : 8995141617 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

The value of a neutron star's magnetic field obtained from the accretion rate

$(B \propto \dot{M})$ gives an estimate of the

- A. large scale dipolar field
- B. dipolar field at Alfvén radius
- C. total field strength at light cylinder
- D. higher multipoles at the surface

Options :

- 8995146440. 1

8995146441. 2

8995146442. 3

8995146443. 4

Question Number : 22 Question Id : 8995141618 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

A $1.4 M_{\odot}$ neutron star is supported against gravity by

- A. degeneracy pressure of neutrons alone
- B. degeneracy pressure of neutrons combined with repulsive nuclear interaction
- C. repulsive nuclear interactions alone
- D. degeneracy pressure of electrons

Options :

8995146444. 1

8995146445. 2

8995146446. 3

8995146447. 4

Question Number : 23 Question Id : 8995141619 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

The number of neutron stars in our Galaxy is estimated to be of order

- A. 10^5
- B. 10^7
- C. 10^9
- D. 10^{11}

Options :

- 8995146448. 1
- 8995146449. 2
- 8995146450. 3
- 8995146451. 4

Question Number : 24 Question Id : 8995141620 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

For accreting hydrogen-rich matter, the energy generated by nuclear burning E_{nuc} on the surface of a compact star compares with its gravitational binding energy E_g as

- A. $E_g > E_{\text{nuc}}$ for both neutron star and white dwarf
- B. $E_g < E_{\text{nuc}}$ for both neutron star and white dwarf
- C. $E_g > E_{\text{nuc}}$ for white dwarf and $E_g < E_{\text{nuc}}$ for neutron star
- D. $E_g < E_{\text{nuc}}$ for white dwarf and $E_g > E_{\text{nuc}}$ for neutron star

Options :

- 8995146452. 1

8995146453. 2

8995146454. 3

8995146455. 4

Question Number : 25 Question Id : 8995141621 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

What is stellar inclination?

- A. The angle between the star, the Earth and the Sun
- B. The angle between the axis of rotation of the star and an observer's line of sight on Earth
- C. The ratio of the equatorial to polar rotation rates of the star
- D. The change in the angle of the axes of surface and core rotation

Options :

8995146456. 1

8995146457. 2

8995146458. 3

8995146459. 4

Sub-Section Number : 2
Sub-Section Id : 89951431
Question Shuffling Allowed : Yes

Question Id : 8995141622 Question Type : COMPREHENSION Sub Question Shuffling Allowed : Yes Group Comprehension Questions : No

Question Numbers : (26 to 50)

Question Label : Comprehension

CONSTANTS AND CONVERSION FACTORS:

Speed of light $c = 3 \times 10^8 \text{ms}^{-1}$

Planck's constant $h = 6.626 \times 10^{-34} \text{J} \cdot \text{s}$

Gravitational constant $G = 6.674 \times 10^{-11} \text{m}^3 \text{kg}^{-1} \text{s}^{-2}$

Mass of proton $m_p = 1.673 \times 10^{-27} \text{kg}$

Mass of electron $m_e = 9.109 \times 10^{-31} \text{kg}$

Stefan-Boltzmann constant $\sigma = 5.670 \times 10^{-8} \text{Jm}^{-2} \text{s}^{-1} \text{K}^{-4}$

Boltzmann constant $k = 1.381 \times 10^{-23} \text{JK}^{-1}$

Mass of Sun $M_{\odot} = 1.989 \times 10^{30} \text{kg}$

Luminosity of Sun $L_{\odot} = 3.83 \times 10^{26} \text{W}$

Radius of Sun $R_{\odot} = 6.96 \times 10^8 \text{m}$

Mass of Earth $M_{\oplus} = 5.972 \times 10^{24} \text{kg}$

$$1 \text{eV} = 1.602 \times 10^{-19} \text{J}$$

$1 \text{pc} = 3.26 \text{ly}$; $1 \text{pc} = 3.086 \times 10^{16} \text{m}$; $1 \text{ly} = 9.461 \times 10^{15} \text{m}$

$$1 \text{yr} = 3.154 \times 10^7 \text{s}$$

Sub questions

Question Number : 26 Question Id : 8995141623 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is

Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

RR Lyrae variable stars obey an absolute magnitude-metallicity relation of the form $M_V = 0.23[\text{Fe}/\text{H}] + 0.984$. If $[\text{Fe}/\text{H}] = -1.5$ dex and apparent magnitude $m_V = 19.8$ mag, then the distance to an RR Lyrae is

- A. 67.95 kpc
- B. 61.23 kpc
- C. 78.34 kpc
- D. 10.29 kpc

Options :

- 8995146460. 1
- 8995146461. 2
- 8995146462. 3
- 8995146463. 4

Question Number : 27 Question Id : 8995141624 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

Which of the following stars has the longest pre-main sequence phase?

- A. $5.5 M_{\odot}$
- B. $10 M_{\odot}$
- C. $3 M_{\odot}$
- D. $1 M_{\odot}$

Options :

- 8995146464. 1

8995146465. 2

8995146466. 3

8995146467. 4

Question Number : 28 Question Id : 8995141625 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

A radio interferometer must necessarily

- A. observe over a broad spectral band
- B. offer observations with a high time resolution
- C. comprise of a number of individual telescopes or elements
- D. be built at very high altitudes

Options :

8995146468. 1

8995146469. 2

8995146470. 3

8995146471. 4

Question Number : 29 Question Id : 8995141626 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Suppose degeneracy lifting due to rotation (normally expected) is not observed in the oscillation spectrum of a main sequence star. This could be because

- A. the star is non-rotating
- B. magnetism in the star has the opposite impact on degeneracy as rotation, and the net observed degeneracy is therefore zero in the observations
- C. the signal-to-noise ratio of the spectrum is too low to observe this
- D. degeneracy lifting due to rotation occurs only in young stars

Options :

8995146472. 1

8995146473. 2

8995146474. 3

8995146475. 4

Question Number : 30 Question Id : 8995141627 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

What is the current local ISM Lithium abundance?

- A. Same as what is made during Big Bang as predicted by CMB - $A(\text{Li}) = 2.7$
- B. Same as the Lithium abundance that are seen in halo stars $A(\text{Li}) = 2.1$
- C. Same as the Lithium abundance observed in Sun $A(\text{Li}) = 1.5$
- D. $A(\text{Li}) > 3$

Options :

- 8995146476. 1
- 8995146477. 2
- 8995146478. 3
- 8995146479. 4

Question Number : 31 Question Id : 8995141628 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Median metallicity of halo stars is given by

- A. $[\text{Fe}/\text{H}] \sim 0.0$
- B. $[\text{Fe}/\text{H}] \sim +1.2$
- C. $[\text{Fe}/\text{H}] \sim -1.2$
- D. $[\text{Fe}/\text{H}] \sim -4.0$

Options :

- 8995146480. 1
- 8995146481. 2

8995146482. 3

8995146483. 4

Question Number : 32 Question Id : 8995141629 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

The Eddington Luminosity L_{Edd} and the Eddington accretion rate \dot{M}_{Edd}

for a $1 M_{\odot}$ White Dwarf (WD) and for a $1.4 M_{\odot}$ Neutron Star (NS) compare as follows:

- A. $L_{\text{Edd}}(\text{WD}) < L_{\text{Edd}}(\text{NS})$ and $\dot{M}_{\text{Edd}}(\text{WD}) > \dot{M}_{\text{Edd}}(\text{NS})$
- B. $L_{\text{Edd}}(\text{WD}) < L_{\text{Edd}}(\text{NS})$ and $\dot{M}_{\text{Edd}}(\text{WD}) < \dot{M}_{\text{Edd}}(\text{NS})$
- C. $L_{\text{Edd}}(\text{WD}) > L_{\text{Edd}}(\text{NS})$ and $\dot{M}_{\text{Edd}}(\text{WD}) > \dot{M}_{\text{Edd}}(\text{NS})$
- D. $L_{\text{Edd}}(\text{WD}) > L_{\text{Edd}}(\text{NS})$ and $\dot{M}_{\text{Edd}}(\text{WD}) < \dot{M}_{\text{Edd}}(\text{NS})$

Options :

8995146484. 1

8995146485. 2

8995146486. 3

8995146487. 4

Question Number : 33 Question Id : 8995141630 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

If the spin-period of a radio pulsar is 1s, what is the radius of its light cylinder?

- A. $\sim 5 \times 10^8$ cm
- B. $\sim 3 \times 10^9$ cm
- C. $\sim 5 \times 10^9$ cm
- D. $\sim 3 \times 10^8$ cm

Options :

- 8995146488. 1
- 8995146489. 2
- 8995146490. 3
- 8995146491. 4

Question Number : 34 Question Id : 8995141631 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Why are there no stellar configurations supported purely by neutron degeneracy pressure?

- A. M_{\max} for neutron degeneracy is smaller than M_{Ch}
- B. Neutrons never go into a degenerate state
- C. Protons are always present
- D. Neutrons become superfluid before becoming degenerate

Options :

- 8995146492. 1

8995146493. 2

8995146494. 3

8995146495. 4

Question Number : 35 Question Id : 8995141632 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

The bolometric flux measured from a star is $3.4 \times 10^{-12} \text{ W/m}^2$. If the distance to the star is 450 pc, then the luminosity of the star is

A. $21.5 L_{\odot}$

B. $37.8 L_{\odot}$

C. $96.3 L_{\odot}$

D. $54.2 L_{\odot}$

Options :

8995146496. 1

8995146497. 2

8995146498. 3

8995146499. 4

Question Number : 36 Question Id : 8995141633 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

If we take a large number of random nearby stars at a given instance and plot them on the HR diagram, we observe that most lie in the main-sequence band. From this, we can infer that

- A. the giant stars are faint and hence cannot be detected
- B. since Sun is a main-sequence star, all stars have same temperature and size as Sun
- C. main-sequence stars having high effective temperature have lower luminosities and vice-versa
- D. stars spend most of their lifetime in the main-sequence phase

Options :

- 8995146500. 1
- 8995146501. 2
- 8995146502. 3
- 8995146503. 4

Question Number : 37 Question Id : 8995141634 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

When light is incident on a purely absorbing medium, the incident intensity

- A. increases linearly across the medium
- B. decreases linearly across the medium
- C. increases exponentially across the medium
- D. decreases exponentially across the medium

Options :

- 8995146504. 1
- 8995146505. 2
- 8995146506. 3
- 8995146507. 4

Question Number : 38 Question Id : 8995141635 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Two stars A and B in a binary system are found to have masses of $2 M_{\odot}$ and $1 M_{\odot}$ respectively. Their radii are $R_A \sim 1.7 R_{\odot}$ and $R_B \sim 0.008 R_{\odot}$.

- A. A is a red-giant star
- B. A is a white dwarf star
- C. B is a red-giant star
- D. B is a white dwarf star

Options :

- 8995146508. 1
- 8995146509. 2
- 8995146510. 3

8995146511.4

Question Number : 39 Question Id : 8995141636 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

The typical neutron star magnetic field in an HMXB is

- A. 10^6 G
- B. 10^8 G
- C. 10^{12} G
- D. 10^{10} G

Options :

- 8995146512.1
- 8995146513.2
- 8995146514.3
- 8995146515.4

Question Number : 40 Question Id : 8995141637 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

Why do magnetic flux tubes rise up through solar (stellar) convection zones to produce sunspots (starspots) on the surface?

- A. Because there is no plasma within flux tubes
- B. Because the plasma inside flux tubes is hotter
- C. Because excess magnetic pressure implies lower internal gas pressure
- D. Because there is Hydrogen gas inside flux tube

Options :

8995146516. 1

8995146517. 2

8995146518. 3

8995146519. 4

Question Number : 41 Question Id : 8995141638 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

If the ratio of the masses of the two components of a binary star is 1:3, the orbital period of the binary star is 1 year and semi-major axis of the relative orbit is 2 AU, the masses of the individual components of the binary star in terms of solar masses are, respectively,

- A. 1, 3
- B. 3, 9
- C. 2, 6
- D. 2.4, 7.2

Options :

8995146520. 1

8995146521. 2

8995146522. 3

8995146523. 4

Question Number : 42 Question Id : 8995141639 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

How does the change in frequency splitting with spherical harmonic degree reveal latitudinal variations in rotation rate?

- A. Modes of various harmonic degrees sample latitudes differently and can therefore sense variations
- B. Different harmonic degrees can only sample different radial layers so this measurement cannot reveal latitudinal variations
- C. Different harmonic degrees are excited at different latitudes and propagate only on those latitudes
- D. It is not possible to measure latitudinal variations in rotation rate using modes

Options :

- 8995146524. 1
- 8995146525. 2
- 8995146526. 3
- 8995146527. 4

Question Number : 43 Question Id : 8995141640 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

The orbital period of a binary is 1 year and the line of sight speed of the secondary is 70 km/s. What is the nature of the primary?

- A. Black hole
- B. Neutron star
- C. Quark star
- D. White dwarf

Options :

- 8995146528. 1
- 8995146529. 2
- 8995146530. 3
- 8995146531. 4

Question Number : 44 Question Id : 8995141641 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

An observer is located at New Delhi at the following coordinates: 28.6139° N, 77.2090° E. Which one of the following objects will be visible to the observer in the Delhi night sky at some time in the year?

- A. Large Magellanic Cloud: RA = $05^{\text{hr}} 23^{\text{m}} 34.6^{\text{s}}$, Dec = $-69^\circ 45' 22''$
- B. Bellatrix: RA = $05^{\text{hr}} 25^{\text{m}} 07.86^{\text{s}}$, Dec = $+06^\circ 20' 58.9''$
- C. Globular Cluster NGC 2808: RA = $09^{\text{hr}} 12^{\text{m}} 03.10^{\text{s}}$, Dec = $-64^\circ 51' 48.6''$
- D. Sigma Octantis: RA = $20^{\text{hr}} 15^{\text{m}} 03.21^{\text{s}}$, Dec = $-89^\circ 08' 18.4''$

Options :

- 8995146532. 1
- 8995146533. 2
- 8995146534. 3
- 8995146535. 4

Question Number : 45 Question Id : 8995141642 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

Two stars A and B have the following spectral characteristics. A displays a peak in near-infrared, has broad absorption bands and hydrogen atomic lines are not visible. Its luminosity is higher than B. B on the other hand, displays Balmer jump, atomic hydrogen lines and is a main-sequence star.

Then what can be conclude about spectral types of A and B?

- A. A and B are of spectral types AV and MIII, respectively
- B. A and B are of spectral types AIII and MV, respectively
- C. A and B are of spectral types MIII and AV, respectively
- D. A and B are of spectral types MV and AIII, respectively

Options :

8995146536. 1

8995146537. 2

8995146538. 3

8995146539. 4

Question Number : 46 Question Id : 8995141643 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Solve the equation of hydrostatic equilibrium for a sphere of uniform density when the pressure is zero at the surface. Using this, we find that the pressure at centre of Sirius B whose mass is $1 M_{\odot}$ and radius is $0.008 R_{\odot}$ is

- A. $8.2 \times 10^{23} \text{ N/m}^2$
- B. $5.6 \times 10^{21} \text{ N/m}^2$
- C. $1.2 \times 10^{25} \text{ N/m}^2$
- D. $3.3 \times 10^{22} \text{ N/m}^2$

Options :

- 8995146540. 1
- 8995146541. 2
- 8995146542. 3
- 8995146543. 4

Question Number : 47 Question Id : 8995141644 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

The spectral type DB corresponds to

- A. giant stars with having Hydrogen lines
- B. white dwarfs with Helium lines and no Hydrogen lines
- C. sub-dwarfs with neutral metal absorption lines
- D. variable stars lying along horizontal branch having both Hydrogen and Helium lines

Options :

8995146544. 1

8995146545. 2

8995146546. 3

8995146547. 4

Question Number : 48 Question Id : 8995141645 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Which of the following statements is NOT true for solar radio emissions?

- A. They can carry information about the large scale coronal electron density and temperature distribution
- B. They can carry information about the distribution of mildly relativistic electrons trapped in CME plasma
- C. They can potentially be used for measuring the detailed three dimensional magnetic field structure of a CME
- D. They can be useful sources of information about the propagation effects through the inhomogeneous and turbulent plasma

Options :

- 8995146548. 1
- 8995146549. 2
- 8995146550. 3
- 8995146551. 4

Question Number : 49 Question Id : 8995141646 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

If for a star $(B-V) = 0.4$ mag and $(B-V)_0 = 0.35$ mag, given that $R_V=3.2$.

Then the interstellar extinction A_V is given by

- A. 0.12 mag
- B. 0.16 mag
- C. 0.80 mag
- D. 0.20 mag

Options :

8995146552. 1

8995146553. 2

8995146554. 3

8995146555. 4

Question Number : 50 Question Id : 8995141647 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Low mass stars are maximum when slope of the Initial Mass Function is

- A. -4.5
- B. -3.5
- C. -2.5
- D. -0.5

Options :

8995146556. 1

8995146557. 2

8995146558. 3

8995146559. 4

Sub-Section Number :

3

Sub-Section Id :

89951432

Question Shuffling Allowed :

Yes

Question Id : 8995141648 Question Type : COMPREHENSION Sub Question Shuffling Allowed : Yes Group Comprehension Questions : No

Question Numbers : (51 to 75)

Question Label : Comprehension

CONSTANTS AND CONVERSION FACTORS:

Speed of light $c = 3 \times 10^8 \text{ms}^{-1}$

Planck's constant $h = 6.626 \times 10^{-34} \text{J} \cdot \text{s}$

Gravitational constant $G = 6.674 \times 10^{-11} \text{m}^3 \text{kg}^{-1} \text{s}^{-2}$

Mass of proton $m_p = 1.673 \times 10^{-27} \text{kg}$

Mass of electron $m_e = 9.109 \times 10^{-31} \text{kg}$

Stefan-Boltzmann constant $\sigma = 5.670 \times 10^{-8} \text{Jm}^{-2} \text{s}^{-1} \text{K}^{-4}$

Boltzmann constant $k = 1.381 \times 10^{-23} \text{JK}^{-1}$

Mass of Sun $M_{\odot} = 1.989 \times 10^{30} \text{kg}$

Luminosity of Sun $L_{\odot} = 3.83 \times 10^{26} \text{W}$

Radius of Sun $R_{\odot} = 6.96 \times 10^8 \text{m}$

Mass of Earth $M_{\oplus} = 5.972 \times 10^{24} \text{kg}$

$$1\text{eV} = 1.602 \times 10^{-19} \text{J}$$

$1\text{pc} = 3.26\text{ly}$; $1\text{pc} = 3.086 \times 10^{16} \text{m}$; $1\text{ly} = 9.461 \times 10^{15} \text{m}$

$$1\text{yr} = 3.154 \times 10^7 \text{s}$$

Sub questions

Question Number : 51 Question Id : 8995141649 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

A magnetic flux tube in the Sun's atmosphere is completely destroyed by a violent magnetic reconnection process. If the flux tube had a field strength of 1000 Gauss, radius of 10,000 km and a length of 20,000 km what is the amount of energy released in the process?

- A. 2.5×10^{32} J
- B. 5.0×10^{10} J
- C. 2.0×10^{32} J
- D. 2.5×10^{25} J

Options :

- 8995146560. 1
- 8995146561. 2
- 8995146562. 3
- 8995146563. 4

Question Number : 52 Question Id : 8995141650 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

What are Pop-III stars?

- A. Stars with $[\text{Fe}/\text{H}] \sim 0.0$
- B. Stars with $[\text{Fe}/\text{H}] \sim -1.0$
- C. Stars with $Z = 0.00$
- D. Stars with $Z = 0.02$

Options :

- 8995146564. 1
- 8995146565. 2
- 8995146566. 3
- 8995146567. 4

Question Number : 53 Question Id : 8995141651 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

Estimate the maximum strength of the magnetic field that can be supported by a neutron star ($M = 1.4 M_{\odot}$, $R = 10 \text{ km}$) in its centre.

- A. $\sim 10^{14} \text{ G}$
- B. $\sim 10^{16} \text{ G}$
- C. $\sim 10^{18} \text{ G}$
- D. $\sim 10^{20} \text{ G}$

Options :

- 8995146568. 1
- 8995146569. 2
- 8995146570. 3

8995146571. 4

Question Number : 54 Question Id : 8995141652 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

Which one of the following has dimension of mass?

- A. hcG
- B. hG/c
- C. $(hc/G)^{1/2}$
- D. $(hG/c)^{3/2}$

Options :

- 8995146572. 1
- 8995146573. 2
- 8995146574. 3
- 8995146575. 4

Question Number : 55 Question Id : 8995141653 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

In the absence of General Relativity, the limiting mass of a pure neutron configuration held by degeneracy pressure would be nearly

- A. $0.72 M_{\odot}$
- B. $1.44 M_{\odot}$
- C. $2.88 M_{\odot}$
- D. $5.76 M_{\odot}$

Options :

- 8995146576. 1
- 8995146577. 2
- 8995146578. 3
- 8995146579. 4

Question Number : 56 Question Id : 8995141654 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Which of the following phenomena is not a likely cause of pulsar glitches?

- A. Nulling
- B. Superfluid vortex unpinning
- C. Thermal pulse due to star quake
- D. Crust cracking due to magnetic stress

Options :

- 8995146580. 1
- 8995146581. 2

8995146582. 3

8995146583. 4

Question Number : 57 Question Id : 8995141655 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

What fraction of Solar-type stars have been observed to have planets?

- A. At least 30%
- B. 10 - 20%
- C. 5 - 10%
- D. less than 5%

Options :

8995146584. 1

8995146585. 2

8995146586. 3

8995146587. 4

Question Number : 58 Question Id : 8995141656 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

What is the dominant source of energy that is expended in a radio pulsars?

- A. internal heat of formation
- B. rotational energy
- C. magnetic energy
- D. gravitational potential

Options :

- 8995146588. 1
- 8995146589. 2
- 8995146590. 3
- 8995146591. 4

Question Number : 59 Question Id : 8995141657 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

The Sun's magnetic activity follows a

- A. 7 - year cycle
- B. 11 - year cycle
- C. 4 - year cycle
- D. 6 - year cycle

Options :

- 8995146592. 1
- 8995146593. 2
- 8995146594. 3

8995146595.4

Question Number : 60 Question Id : 8995141658 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

What is the observed range of M/R for a neutron star?

- A. $0.1 - 0.5 M_{\odot}/\text{km}$
- B. $0.5 - 1 M_{\odot}/\text{km}$
- C. $0.05 - 0.3 M_{\odot}/\text{km}$
- D. $1 - 2 M_{\odot}/\text{km}$

Options :

- 8995146596.1
- 8995146597.2
- 8995146598.3
- 8995146599.4

Question Number : 61 Question Id : 8995141659 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

What is the minimum period a pulsar can sustain without disintegration?

- A. 0.5 ms
- B. 1.5 ms
- C. 0.5 s
- D. 1 ms

Options :

- 8995146600. 1
- 8995146601. 2
- 8995146602. 3
- 8995146603. 4

Question Number : 62 Question Id : 8995141660 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Which of the following results do not follow from helioseismology?

- A. Measurement of the Sun's core temperature
- B. Mechanism of coronal heating
- C. Constraining the neutrino flux
- D. Depth of the convection zone

Options :

- 8995146604. 1
- 8995146605. 2
- 8995146606. 3
- 8995146607. 4

Question Number : 63 Question Id : 8995141661 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

How does the size of these compact stars compare (R_{NS} , R_{WD} , and R_{BH} are the radii of a neutron star, a white dwarf, and a 1 solar mass black hole, respectively)?

- A. $R_{NS} > R_{WD} > R_{BH}$
- B. $R_{WD} > R_{NS} > R_{BH}$
- C. $R_{BH} > R_{NS} > R_{WD}$
- D. $R_{BH} = R_{NS} < R_{WD}$

Options :

8995146608. 1

8995146609. 2

8995146610. 3

8995146611. 4

Question Number : 64 Question Id : 8995141662 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

The pulsar timing arrays are sensitive to what frequency of gravitational waves?

- A. Mega-Hertz
- B. Few Hertz
- C. milli-Hertz
- D. nano-Hertz

Options :

8995146612. 1

8995146613. 2

8995146614. 3

8995146615. 4

Question Number : 65 Question Id : 8995141663 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

What can be inferred from the sound speed in a region of the Sun's interior?

- A. small- and large-scale flows
- B. magnetic fields
- C. temperature fluctuations
- D. nuclear burning rates

Options :

8995146616. 1

8995146617. 2

8995146618.3

8995146619.4

Question Number : 66 Question Id : 8995141664 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Most of the pulsars are detected in which electromagnetic band?

- A. Gamma-rays
- B. X-rays
- C. Optical
- D. Radio

Options :

8995146620.1

8995146621.2

8995146622.3

8995146623.4

Question Number : 67 Question Id : 8995141665 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

At the end of its life, the Sun will leave behind which kind of remnant?

- A. White dwarf
- B. Black hole
- C. Neutron star
- D. Brown Dwarf

Options :

- 8995146624. 1
- 8995146625. 2
- 8995146626. 3
- 8995146627. 4

Question Number : 68 Question Id : 8995141666 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

How is the estimated magnetic field of a pulsar related to its period?

- A. $B \propto P$
- B. $B \propto P^{1/2}$
- C. $B \propto P^2$
- D. $B \propto 1/P$

Options :

- 8995146628. 1
- 8995146629. 2
- 8995146630. 3
- 8995146631. 4

Question Number : 69 Question Id : 8995141667 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

The large and small spacing of the stellar oscillation modes are used to infer, respectively, the star's

- A. average density and age
- B. average density and core temperature
- C. core temperature and composition
- D. age and composition

Options :

8995146632. 1

8995146633. 2

8995146634. 3

8995146635. 4

Question Number : 70 Question Id : 8995141668 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Which emission mechanism can explain the radio emission from a pulsar?

- A. Blackbody radiation
- B. Incoherent synchrotron radiation
- C. Coherent curvature radiation
- D. Inverse-Compton radiation

Options :

8995146636. 1

8995146637. 2

8995146638. 3

8995146639. 4

Question Number : 71 Question Id : 8995141669 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

A white dwarf (WD) with a mass less than 0.5 solar masses will likely be a

- A. Oxygen-Neon-Magnesium WD
- B. Carbon WD
- C. Helium WD
- D. Carbon-Oxygen WD

Options :

8995146640. 1

8995146641. 2

8995146642. 3

8995146643. 4

Question Number : 72 Question Id : 8995141670 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

The brightness temperature estimate of a typical pulsar's radio emission is of the order

- A. 10^3 K
- B. 10^{12} K
- C. 10^{24} K
- D. 10^{33} K

Options :

- 8995146644. 1
- 8995146645. 2
- 8995146646. 3
- 8995146647. 4

Question Number : 73 Question Id : 8995141671 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

Red giants exhibit oscillation frequencies of the order of

- A. milli-Hertz
- B. nano-Hertz
- C. kilo-Hertz
- D. micro-Hertz

Options :

- 8995146648. 1
- 8995146649. 2
- 8995146650. 3

8995146651.4

Question Number : 74 Question Id : 8995141672 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

Roemer delay is the pulse time of arrival delay caused by the effect of

- A. the Sun's spacetime curvature correction
- B. the Earth's gravitational field
- C. light travel time from the telescope to the solar system barycentre
- D. dispersion measure

Options :

8995146652.1

8995146653.2

8995146654.3

8995146655.4

Question Number : 75 Question Id : 8995141673 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

The core overcomes degeneracy pressure and nuclear burning continues all the way to Fe (Iron) beyond stellar mass of about

- A. 5 solar mass
- B. 10 solar mass
- C. 15 solar mass
- D. 20 solar mass

Options :

- 8995146656. 1
- 8995146657. 2
- 8995146658. 3
- 8995146659. 4

Sub-Section Number : 4
Sub-Section Id : 89951433
Question Shuffling Allowed : Yes

Question Id : 8995141674 Question Type : COMPREHENSION Sub Question Shuffling Allowed : Yes Group Comprehension Questions : No

Question Numbers : (76 to 100)

Question Label : Comprehension

CONSTANTS AND CONVERSION FACTORS:

Speed of light $c = 3 \times 10^8 \text{ms}^{-1}$

Planck's constant $h = 6.626 \times 10^{-34} \text{J} \cdot \text{s}$

Gravitational constant $G = 6.674 \times 10^{-11} \text{m}^3 \text{kg}^{-1} \text{s}^{-2}$

Mass of proton $m_p = 1.673 \times 10^{-27} \text{kg}$

Mass of electron $m_e = 9.109 \times 10^{-31} \text{kg}$

Stefan-Boltzmann constant $\sigma = 5.670 \times 10^{-8} \text{Jm}^{-2} \text{s}^{-1} \text{K}^{-4}$

Boltzmann constant $k = 1.381 \times 10^{-23} \text{JK}^{-1}$

Mass of Sun $M_{\odot} = 1.989 \times 10^{30} \text{kg}$

Luminosity of Sun $L_{\odot} = 3.83 \times 10^{26} \text{W}$

Radius of Sun $R_{\odot} = 6.96 \times 10^8 \text{m}$

Mass of Earth $M_{\oplus} = 5.972 \times 10^{24} \text{kg}$

$$1 \text{eV} = 1.602 \times 10^{-19} \text{J}$$

$1 \text{pc} = 3.26 \text{ly}$; $1 \text{pc} = 3.086 \times 10^{16} \text{m}$; $1 \text{ly} = 9.461 \times 10^{15} \text{m}$

$$1 \text{yr} = 3.154 \times 10^7 \text{s}$$

Sub questions

Question Number : 76 Question Id : 8995141675 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is

Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

A star like our Sun goes through several evolutionary phases during its life cycle. Select which is the correct sequence.

- A. Giant molecular cloud → T Tauri star → protostar → main sequence → red giant branch → horizontal branch → asymptotic giant branch → helium flash → planetary nebula → white dwarf
- B. Giant molecular cloud → protostar → main sequence → red giant branch → helium flash → horizontal branch → T Tauri star → asymptotic giant branch → planetary nebula → white dwarf
- C. Giant molecular cloud → protostar → T Tauri star → main sequence → red giant branch → helium flash → horizontal branch → asymptotic giant branch → planetary nebula → white dwarf
- D. Giant molecular cloud → protostar → main sequence → T Tauri star → helium flash → horizontal branch → asymptotic giant branch → planetary nebula → red giant branch → white dwarf

Options :

- 8995146660. 1
- 8995146661. 2
- 8995146662. 3
- 8995146663. 4

Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Three stars of $5 M_{\odot}$, $3 M_{\odot}$ and $1 M_{\odot}$ are born in the same molecular cloud.

Choose the correct answer for their metallicities.

- A. Their metallicities are similar
- B. Their metallicities increase linearly with mass
- C. Their metallicities decrease linearly with mass
- D. The metallicities of $1 M_{\odot}$ and $3 M_{\odot}$ stars are similar but that of the $5M_{\odot}$ star higher

Options :

8995146664. 1

8995146665. 2

8995146666. 3

8995146667. 4

Question Number : 78 Question Id : 8995141677 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is

Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

The luminosity and main sequence life span of a $10 M_{\odot}$ main sequence star are

- A. $60 L_{\odot}$ and 3×10^6 years
- B. $600 L_{\odot}$ and 5×10^9 years
- C. $1000 L_{\odot}$ and 4×10^8 years
- D. $10000 L_{\odot}$ and 2×10^7 years

Options :

- 8995146668. 1
- 8995146669. 2
- 8995146670. 3
- 8995146671. 4

Question Number : 79 Question Id : 8995141678 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

In the Sun the pp chain dominates energy generation while for a star about 1.5 times or more heavier than the Sun the CNO cycle dominates. This is because

- A. only protons are available in the interior of the Sun
- B. there is not enough O in the interior of the Sun
- C. the core temperature in the solar interior is too low for the CNO cycle
- D. the core temperature in the solar interior is too high for the CNO cycle

Options :

8995146672. 1

8995146673. 2

8995146674. 3

8995146675. 4

Question Number : 80 Question Id : 8995141679 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

A photon generated in the interior of the Sun has to make its way to the surface. The time scale taken for a photon to make its way to the surface from the core is approximately (choose the closest answer)

- A. 30000 years
- B. 3000 years
- C. 300 years
- D. 30 years

Options :

8995146676. 1

8995146677. 2

8995146678. 3

8995146679. 4

Question Number : 81 Question Id : 8995141680 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Assuming the Sun to be of uniform density, which is not strictly correct, estimate the magnitude of the gravitational potential energy of the Sun.

- A. 2×10^{31} J
- B. 2×10^{34} J
- C. 2×10^{37} J
- D. 2×10^{41} J

Options :

- 8995146680. 1
- 8995146681. 2
- 8995146682. 3
- 8995146683. 4

Question Number : 82 Question Id : 8995141681 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Energy is carried in the outer part of the Sun from about 0.7 solar radius to the surface by

- A. convection
- B. radiation
- C. conduction
- D. free flow of photons

Options :

- 8995146684. 1
- 8995146685. 2
- 8995146686. 3
- 8995146687. 4

Question Number : 83 Question Id : 8995141682 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Estimate the escape velocity from the Sun as a fraction of the velocity of light.

- A. 2×10^{-3}
- B. 2×10^{-2}
- C. 2×10^{-1}
- D. 0.5

Options :

- 8995146688. 1
- 8995146689. 2
- 8995146690. 3
- 8995146691. 4

Question Number : 84 Question Id : 8995141683 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

The flux measured from two stars is 5.3×10^{-14} W and 3.9×10^{-14} W, respectively. The difference in apparent magnitude of these stars is

- A. 0.325
- B. 1.4
- C. 0.855
- D. 0.13

Options :

8995146692. 1

8995146693. 2

8995146694. 3

8995146695. 4

Question Number : 85 Question Id : 8995141684 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

The distance modulus of a globular cluster is 16.505. The distance to the cluster is

A. 18 kpc

B. 20 kpc

C. 25 kpc

D. 22 kpc

Options :

8995146696. 1

8995146697. 2

8995146698. 3

8995146699. 4

Question Number : 86 Question Id : 8995141685 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

A star is found to have luminosity that is 500 times that of the Sun. If its effective temperature is 6250 K, then its radius (in terms of solar radius) is

- A. 0.2705
- B. 270.5
- C. 27.05
- D. 2.705

Options :

- 8995146700. 1
- 8995146701. 2
- 8995146702. 3
- 8995146703. 4

Question Number : 87 Question Id : 8995141686 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

The absorption lines in stellar spectra are caused by

- A. atomic transitions from high excited states to low energy states.
- B. outer layers of the star which are cooler compared to inner layers.
- C. scattering of radiation by atoms and molecules in the corona of the star.
- D. the angle subtended by the viewing plane.

Options :

- 8995146704. 1
- 8995146705. 2

8995146706.3

8995146707.4

Question Number : 88 Question Id : 8995141687 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Which of the following variable stars helps in direct determination of masses and radii of stars from the light curve geometry?

- A. RR Lyraes
- B. classical cepheids
- C. Mira Variables
- D. Eclipsing binaries

Options :

8995146708.1

8995146709.2

8995146710.3

8995146711.4

Question Number : 89 Question Id : 8995141688 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

The star Algol is observed to have a proper motion of 3.2 milli-arcsec/yr, radial velocity of 4 km/s and parallax of 36.28 milli-arcsec. The distance to Algol is

- A. 27.6 pc
- B. 312.5 pc
- C. 250.0 pc
- D. 195.2 pc

Options :

8995146712. 1

8995146713. 2

8995146714. 3

8995146715. 4

Question Number : 90 Question Id : 8995141689 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

The mass of Vega is $2 M_{\odot}$, radius is $3 R_{\odot}$ and luminosity is $60 L_{\odot}$. The thermal timescale of Vega is

- A. 2×10^3 years
- B. 4×10^5 years
- C. 5×10^6 years
- D. 3×10^7 years

Options :

- 8995146716. 1
- 8995146717. 2
- 8995146718. 3
- 8995146719. 4

Question Number : 91 Question Id : 8995141690 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

At the beginning of a solar cycle

- A. Sunspots are concentrated near the equator
- B. Sunspots appear at relatively higher latitudes (30 - 40 degrees)
- C. The number of Sunspots is at a maximum
- D. sunspots appear uniformly at all latitudes

Options :

- 8995146720. 1
- 8995146721. 2
- 8995146722. 3
- 8995146723. 4

Question Number : 92 Question Id : 8995141691 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

The time of sunrise as seen from the earth

- A. changes everyday
- B. stays the same for a given longitude
- C. does not depend on the latitude
- D. remains the same for the same latitude

Options :

- 8995146724. 1
- 8995146725. 2
- 8995146726. 3
- 8995146727. 4

Question Number : 93 Question Id : 8995141692 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

If the Earth (along with the Moon at the same distance from the earth) was moved to a distance closer to the Sun such that the new distance was half of that of the original distance, then

- A. the angular size of the Sun will become half as before
- B. the angular size of the Sun will become double as that of before
- C. the solar eclipse will remain the same
- D. the effect of the Sun on the Moon will remain unchanged

Options :

8995146728. 1

8995146729. 2

8995146730. 3

8995146731. 4

Question Number : 94 Question Id : 8995141693 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

The observers in two cities, Delhi and Mumbai, observing the star Sirius, will measure

- A. the same altitude and azimuth for Sirius
- B. different RA for Sirius
- C. different Dec for Sirius
- D. same RA and Dec for Sirius

Options :

8995146732. 1

8995146733. 2

8995146734. 3

8995146735. 4

Question Number : 95 Question Id : 8995141694 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

A star is a celestial object that

- A. burns nuclear fuel and is bound by kinetic pressure
- B. shines brightly and is never in hydrostatic equilibrium
- C. emits radiation at optical wavelengths only
- D. burns nuclear fuel and is bound by self gravity

Options :

- 8995146736. 1
- 8995146737. 2
- 8995146738. 3
- 8995146739. 4

Question Number : 96 Question Id : 8995141695 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

The temperature of the core of the Sun is about

- A. little more than one billion degrees Celsius
- B. little more than ten million degrees Celsius
- C. little more than one million degrees Celsius
- D. five hundred thousand degrees Celsius

Options :

- 8995146740. 1
- 8995146741. 2
- 8995146742. 3
- 8995146743. 4

Question Number : 97 Question Id : 8995141696 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

The number of constellations officially recognized by the IAU is

- A. 88
- B. 62
- C. 75
- D. 108

Options :

- 8995146744. 1
- 8995146745. 2
- 8995146746. 3
- 8995146747. 4

Question Number : 98 Question Id : 8995141697 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

For the Sun, the following statement is incorrect:

- A. the density of the core is more than that of the photosphere
- B. the density of the photosphere is more than that of the corona.
- C. the density of the chromosphere is less than that of the core.
- D. the density of the chromosphere is less than that of the corona.

Options :

- 8995146748. 1

8995146749. 2

8995146750. 3

8995146751. 4

Question Number : 99 Question Id : 8995141698 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

The location of the zenith for an observer

- A. remains the same for all observers
- B. rotates along with the rotation of the celestial sphere
- C. is defined differently for different coordinate systems
- D. can be measured by measuring the nadir

Options :

8995146752. 1

8995146753. 2

8995146754. 3

8995146755. 4

Question Number : 100 Question Id : 8995141699 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical Correct Marks : 1 Wrong Marks : 0

For a more precise measurement of the parallax of a given star, the minimum observation time required on Earth is

- A. 1 month
- B. 3 months
- C. 4 months
- D. 6 months

Options :

- 8995146756. 1
- 8995146757. 2
- 8995146758. 3
- 8995146759. 4