National Testing Agency

Question Paper Name:	Stars and Stellar Systems 16th Feb 2020 Shift 1
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Stars and Stellar Systems

Group Number :	1
Group Id :	28860744
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 :	28860747
Section Number :	1
Section type :	Online
Mandatory or Optional:	Mandatory
Number of Questions:	4
Number of Questions to be attempted:	4
Section Marks:	100

Sub-Section Number:	1
Sub-Section Id:	28860750
Question Shuffling Allowed :	Yes

Question Id : 2886073995 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 $c = 3 \times 10^8 ms^{-1}$

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

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

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

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

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

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

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

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

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

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

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

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

$$1yr = 3.154 \times 10^7 s$$

Sub questions

Question Number : 1 Question Id : 2886073996 Question Type : MCQ Option Shuffling : No Correct Marks : 1 Wrong Marks : 0

The primary elements made during a type-Ia supernovae

A. Fe-peak elements

B. Alpha-rich elements

C. r-process elements

D. s-process elements

Options :

28860715953. 1

28860715954. 2

28860715955. 3

28860715956. 4

Question Number : 2 Question Id : 2886073997 Question Type : MCQ Option Shuffling : No Correct Marks : 1 Wrong Marks : 0

What is the main mechanism of production of Beryllium?

A. Cosmic ray spallation

B. Big bang nucleosynthesis

C. CNO cycle

D. p-p Chain

Options :

28860715957. 1

28860715958. 2

28860715959. 3

28860715960. 4

Question Number : 3 Question Id : 2886073998 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Which among the following elements is produced largely from neutron star – neutron star mergers?

A. Lithium

B. Carbon

C. Iron

D. Europium

Options :

28860715961. 1

28860715962. 2

28860715963. 3

28860715964. 4

Question Number : 4 Question Id : 2886073999 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Members of a star cluster are bound by

A. magnetic force

B. electric force

C. electromagnetic force

D. gravitational force

Options :

28860715965. 1

28860715966. 2

28860715967. 3

28860715968. 4

Question Number : 5 Question Id : 2886074000 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Most globular clusters were formed

A. about 5 Myr ago

B. about 25 Myr ago

C. about 240 Myr ago

D. about 12 Gyr ago

Options :

28860715969. 1

28860715970. 2

28860715971. 3

28860715972. 4

Question Number : 6 Question Id : 2886074001 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Total solar eclipse occurs when the Moon completely covers the Sun. This is possible because

A. the radius of Moon is much larger than the radius of Sun

B. angular size of Moon is much smaller than the angular size of the Sun

C. Sun and Moon have similar angular sizes, although their distances from Earth are different

D. Sun and Moon are of the same physical size

Options :

28860715973. 1

28860715974. 2

28860715975. 3

28860715976. 4

Question Number : 7 Question Id : 2886074002 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

In white dwarfs, hydrostatic equilibrium is maintained due to

A. degeneracy pressure of non-relativistic electrons

B. degeneracy pressure of relativistic electrons

C. thermal pressure

D. radiation pressure

Options :

28860715977. 1

28860715978. 2

28860715979. 3

28860715980. 4

Question Number : 8 Question Id : 2886074003 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Three stars A, B and C all have effective temperature of 14,500 K. However, the width of the lines are different, B is the broadest, while A has the most narrow lines. What can we conclude about the luminosity of these stars?

A. $L_A > L_B > L_C$

B. $L_C > L_B > L_A$

C. $L_A > L_C > L_B$

D. $L_B > L_C > L_A$

Options :

28860715981. 1

28860715982. 2

28860715983. 3

28860715984. 4

Question Number : 9 Question Id : 2886074004 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Complex symmetric structures around young white dwarfs which shine brightly in optical ultraviolet light are

A. sub-dwarfs

B. supernova remnants

C. planetary nebulae

D. molecular clouds

Options :

28860715985. 1

28860715986. 2

28860715987. 3

28860715988. 4

Question Number : 10 Question Id : 2886074005 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

In main-sequence stars of mass 10 $M_{\odot}$ the dominant source of energy production is by

A. CNO cycle

B. p-p chain

C. triple alpha process

D. combination of triple alpha process and p-p chain

Options :

28860715989. 1

28860715990. 2

28860715991. 3

28860715992. 4

Question Number : 11 Question Id : 2886074006 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

In nature, the formation of number of stars of a given mass from a molecular cloud is such that

A. it is unpredictable and varies widely from region to region

B. high mass stars are rare

C. high mass stars are found in same fraction as low mass stars

D. high mass stars are abundant compared to low mass stars

Options :

28860715993. 1

28860715994. 2

28860715995. 3

28860715996. 4

Question Number : 12 Question Id : 2886074007 Question Type : MCQ Option Shuffling : No Correct Marks : 1 Wrong Marks : 0

RR Lyrae stars are

A. Pop I stars

B. Pop II stars

C. high mass stars

D. low mass stars with core H burning

Options :

28860715997. 1

28860715998. 2

28860715999. 3

28860716000. 4

Question Number : 13 Question Id : 2886074008 Question Type : MCQ Option Shuffling : No Correct Marks : 1 Wrong Marks : 0

roAp stars have pulsation periods of the order of

A. an hour

B. few minutes

C. a day

D. a few seconds

Options :

28860716001. 1

28860716002. 2

28860716003. 3

28860716004. 4

Question Number : 14 Question Id : 2886074009 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Cepheid Instability Strip contains

A. beta Cephei and SPB stars

B. RR Lyrae stars only

C. Cepheids only

D. RR Lyrae stars and Cepheids

Options :

28860716005. 1

28860716006. 2

28860716007. 3

28860716008. 4

Question Number : 15 Question Id : 2886074010 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

The Aditya-L1 mission will

A. observe the Sun between hard X-ray to infrared wavelength range

B. observe the Sun only in visible wavelength range

C. observe the Sun in radio wavelengths

D. observe the Sun in gamma rays

Options :

28860716009. 1

28860716010. 2

28860716011. 3

28860716012. 4

Question Number : 16 Question Id : 2886074011 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Type II and III solar radio bursts are examples of

A. thermal emission

B. coherent nonthermal emission

C. incoherent nonthermal emission

D. gyrosynchrotron emission

Options :

28860716013. 1

28860716014. 2

28860716015. 3

28860716016. 4

Question Number : 17 Question Id : 2886074012 Question Type : MCQ Option Shuffling : No Correct Marks : 1 Wrong Marks : 0

Magnetospheres help protect planets by

A. shielding from solar high energy radiation

B. shielding from the solar wind charged particles

C. shielding from solar neutrinos

D. shielding from comets and meteorites

Options :

28860716017. 1

28860716018. 2

28860716019. 3

28860716020. 4

Question Number : 18 Question Id : 2886074013 Question Type : MCQ Option Shuffling : No Correct Marks : 1 Wrong Marks : 0

The electron degeneracy pressure in stellar objects like our Sun is

A. due to electron temperature

B. quantum in origin

C. due to classical nature of a particle

D. due to the charge of an electron

Options :

28860716021. 1

28860716022. 2

28860716023. 3

28860716024. 4

Question Number : 19 Question Id : 2886074014 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

In the Sun, magnetic reconnection

A. refers to the manner in which magnetic fields are swept along with the flow

B. can occur in a plasma where the conductivity is infinite everywhere

C. violates an assumption of ideal magnetohydrodynamics

D. is a process where the magnetic field topology is preserved

Options :

28860716025. 1

28860716026. 2

28860716027. 3

28860716028. 4

Question Number : 20 Question Id : 2886074015 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

The factor causing Shapiro delay, in the 'time of arrival' (ToA) of pulses from a radio pulsar, is

A. the dispersion measure

B. the space-time curvature

C. the gravitational red-shift

D. the relativistic time dilation

Options :

28860716029. 1

28860716030. 2

28860716031. 3

28860716032. 4

Question Number : 21 Question Id : 2886074016 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Neutron stars have been observed to possess surface magnetic fields in the range

A. $10^2 - 10^{10}$ Tesla

B. $10^4 - 10^{10}$ Tesla

C. $10^4 - 10^{14}$ Tesla

D. $10^8 - 10^{14}$ Tesla

Options :

28860716033. 1

28860716034. 2

28860716035. 3

28860716036. 4

Question Number : 22 Question Id : 2886074017 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

The upper mass limit of a white dwarf is decided by

A. the equality of thermal pressure and degeneracy pressure

B. the balance between gravity and radiation pressure

C. electron Fermi energy rising above its rest mass energy

D. dominance of the degeneracy pressure of protons

Options :

28860716037. 1

28860716038. 2

28860716039. 3

28860716040. 4

Question Number : 23 Question Id : 2886074018 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

The formation of a neutron star by core collapse is likely accompanied by

A. a planetary nebula

B. a supernova explosion

C. a gamma ray burst

D. a nova explosion

Options :

28860716041. 1

28860716042. 2

28860716043. 3

28860716044. 4

Question Number : 24 Question Id : 2886074019 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

At birth, which of the following has the highest surface temperature?

A. A 10 $M_\odot$ protostar

B. A 1.5 $M_\odot$ neutron star

C. A 1.2 $M_\odot$ white dwarf

D. A 50 $M_\odot$ main sequence star

Options :

28860716045. 1

28860716046. 2

28860716047. 3

28860716048. 4

Question Number : 25 Question Id : 2886074020 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Suppose the light coming from a distant star dims periodically. What could be causing this?

A. These are due to stellar flares

B. The star could have large magnetic spots

C. Galactic dust hides the star

D. The thermal flux generated by nuclear fusion also changes periodically

Options :

28860716049. 1

28860716050. 2

28860716051. 3

28860716052. 4

Sub-Section Number:	2
Sub-Section Id:	28860751
Question Shuffling Allowed :	Yes

Question Id : 2886074021 Question Type : COMPREHENSION Sub Question Shuffling Allowed : Yes Group Comprehension Questions : No

Question Numbers : (26 to 50)

Question Label : Comprehension

CONSTANTS AND CONVERSION FACTORS:

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

$1yr = 3.154 \times 10^7 s$

Sub questions

Question Number : 26 Question Id : 2886074022 Question Type : MCQ Option Shuffling : No Correct Marks : 1 Wrong Marks : 0

Metallicity of a star [Fe/H]= -1 dex denotes that

A. the star is 10 times more metal rich as compared to the Sun

B. the star is 10 times more metal poor as compared to the Sun

C. the star has the same metallicity as that of the Sun

D. the star has 100 times more metal content than the Sun

Options :

28860716053. 1

28860716054. 2

28860716055. 3

28860716056. 4

Question Number : 27 Question Id : 2886074023 Question Type : MCQ Option Shuffling : No

Correct Marks : 1 Wrong Marks : 0

Which one of the following is the most compact celestial object?

A. Main sequence stars

B. Red giants

C. Neutron stars

D. Pre-main sequence stars

Options :

28860716057. 1

28860716058. 2

28860716059. 3

28860716060. 4

Question Number : 28 Question Id : 2886074024 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Radiance of which spectral line formed in the FUV part of the solar spectrum varies the most from solar minimum to solar maximum?

A. Fe II line

B. Lyman alpha line

C. Mg II line

D. Ca II line

Options :

28860716061. 1

28860716062. 2

28860716063. 3

28860716064. 4

Question Number : 29 Question Id : 2886074025 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

To what aspect of the internal structure of stars are waves dominantly sensitive?

A. Density

B. Luminosity

C. Sound speed

D. Composition

Options :

28860716065. 1

28860716066. 2

28860716067. 3

28860716068. 4

Question Number : 30 Question Id : 2886074026 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Which is the main contributor to the solar Barium abundance?

A. Core collapse supernovae

B. Type-Ia supernovae

C. AGB stars

D. Neutron star mergers

Options :

28860716069. 1

28860716070. 2

28860716071. 3

28860716072. 4

Question Number : 31 Question Id : 2886074027 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

For the mass range 0.45 to 0.6 $M_{\odot}$, the mass (M) and radius R of a white dwarf are related as

A. $R \propto 1/M^{1/3}$

B. $R \propto M^{1/3}$

C. $R \propto M^{3}$

D. $R \propto 1/M^{3}$

Options :

28860716073. 1

28860716074. 2

28860716075. 3

28860716076. 4

Question Number : 32 Question Id : 2886074028 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

What property separates the outer and the inner crust of a Neutron Star?

A. Neutron drip

B. Dissolution of nuclei

C. Proton superconductivity

D. Quark matter

Options :

28860716077. 1

28860716078. 2

28860716079. 3

28860716080. 4

Question Number : 33 Question Id : 2886074029 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Estimate the Ohmic dissipation time-scale of dipolar magnetic fields in a neutron star (R = 10 km) with average electrical conductivity $\sigma \sim 10^{24}\ s^{-1}$.

A. $\sim 5 \times 10^{6}$ years

B. $\sim 5 \times 10^{8}$ years

C. $\sim 5 \times 10^{10}$ years

D. $\sim 5 \times 10^{12}$ years

Options :

28860716081. 1

28860716082. 2

28860716083. 3

28860716084. 4

Question Number : 34 Question Id : 2886074030 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Radio pulsar period glitches can be caused by

A. crust cracking only

B. superfluid spin-down only

C. both crust cracking and superfluid spin-down

D. superconducting flux expulsion

Options :

28860716085. 1

28860716086. 2

28860716087. 3

28860716088. 4

Question Number : 35 Question Id : 2886074031 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

The angular size of a nebula located at a distance of 7.2 kiloparsecs (kpc) is 34''. The size of the nebula is

A. 2.4 pc

B. 1.2 pc

C. 244.8 pc

D. 3.6 pc

Options :

28860716089. 1

28860716090. 2

28860716091. 3

28860716092. 4

Question Number : 36 Question Id : 2886074032 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

The effective temperature of a main-sequence star of mass 15 $M_{\odot}$ is close to

A. 5800 K

B. 11000 K

C. 16000 K

D. 21000 K

Options :

28860716093. 1

28860716094. 2

28860716095. 3

28860716096. 4

Question Number : 37 Question Id : 2886074033 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

For an average lifetime of 10^{-8} s, the natural broadening of Hα line at 656.3 nm is

A. 3.21×10^{-5} nm

B. 6.92×10^{-5} nm

C. 1.43×10^{-5} nm

D. 4.57×10^{-5} nm

Options :

28860716097. 1

28860716098. 2

28860716099. 3

28860716100. 4

Question Number : 38 Question Id : 2886074034 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

In an HR diagram of spectral type versus luminosity,

A. all stars pass through the red-giant phase

B. sub dwarf stars lie above main-sequence band

C. main-sequence turn-off point is at lower luminosity for older clusters

D. a star moves across the main-sequence band during its evolution

Options :

28860716101. 1

28860716102. 2

28860716103. 3

28860716104. 4

Question Number : 39 Question Id : 2886074035 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

The inner accretion disk around an X-ray pulsar likely terminates at

A. magnetospheric radius

B. corotation radius

C. light-cylinder radius

D. neutron star radius

Options :

28860716105. 1

28860716106. 2

28860716107. 3

28860716108. 4

Question Number : 40 Question Id : 2886074036 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Why is it surprising that the temperature of the Sun's outer atmosphere – the corona, is a million degrees?

A. Because the surface is cooler than the outer corona
B. Because the surface is at two million degrees
C. Because the corona has very low density
D. Because the surface cannot transmit energy

Options :

28860716109. 1

28860716110. 2

28860716111. 3

28860716112. 4

Question Number : 41 Question Id : 2886074037 Question Type : MCQ Option Shuffling : No
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, then the masses of the individual components of the binary star in terms of solar masses are respectively given by

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

Options :

28860716113. 1

28860716114. 2

28860716115. 3

28860716116. 4

Question Number : 42 Question Id : 2886074038 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

The reference model of the Sun (which is non-rotating, non-attenuating, non-magnetic and axisymmetric) gives us a self-adjoint wave operator, implies which of these?

A. The reference-model eigenfunctions are orthonormal and complete, and may be linearly superposed to obtain the eigenfunctions of the real Sun
B. The eigenfunctions of the real Sun are not linear combinations of the reference-mode eigenfunctions
C. The reference-model eigenfunctions are not orthonormal and complete, but it may be possible to linearly superpose them to obtain the eigenfunctions of the real Sun
D. The reference-model eigenfunctions are the same as the eigenfunctions of the real Sun

Options :

28860716117. 1

28860716118. 2

28860716119. 3

28860716120. 4

Question Number : 43 Question Id : 2886074039 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Spin equilibrium frequency of an accreting pulsar is 0.5 kHz. The age of the binary system is likely to be

A. about 10^3 years
B. about 10^6 years
C. about 10^9 years
D. about 10^{12} years

Options :

28860716121. 1

28860716122. 2

28860716123. 3

28860716124. 4

Question Number : 44 Question Id : 2886074040 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

The flux of Vega in U band is 1810 Jy. Then the AB magnitude of Vega in this band is

A. 0

B. 0.76

C. 7.6

D. not defined

Options :

28860716125. 1

28860716126. 2

28860716127. 3

28860716128. 4

Question Number : 45 Question Id : 2886074041 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Assume that a star remains 10^9 years in the main-sequence phase and burns 10% of its hydrogen. Then the star expands to a red giant with a luminosity that increases by a factor of 100 from its main-sequence phase. How long is the red giant phase if we assume that energy is produced by burning the remaining hydrogen.

A. 9×10^7 years

B. 9×10^6 years

C. 9×10^5 years

D. 9×10^9 years

Options :

28860716129. 1

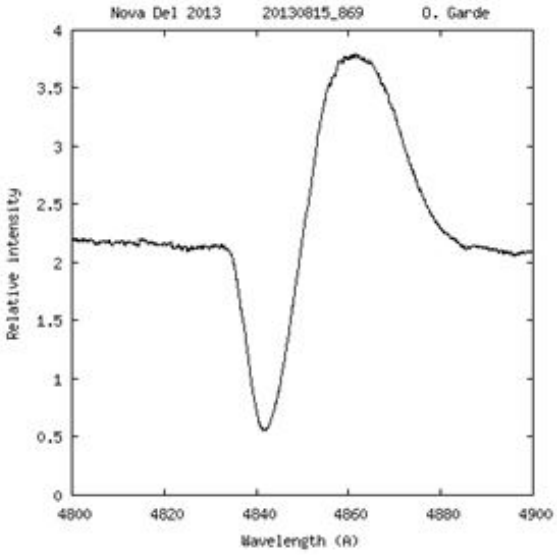
28860716130. 2

28860716131. 3

28860716132. 4

Question Number : 46 Question Id : 2886074042 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

The following plot displays the Hb line of V339 Del. From the P-Cygni profile, estimate the velocity of the wind moving outwards.



A. 1234.5 km/s

B. 2675.2 km/s

C. 367.2 km/s

D. 796.2 km/s

Options :

28860716133. 1

28860716134. 2

28860716135. 3

28860716136. 4

Question Number : 47 Question Id : 2886074043 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

The Sun will go through the following stages of evolution after the main-sequence phase.

A. Subgiant – Red giant – He flash – Asymptotic giant – Horizontal Branch – Planetary Nebula – White Dwarf
B. Subgiant – Red giant – Horizontal Branch – He flash – Asymptotic giant – Planetary Nebula – White Dwarf
C. Subgiant – Red giant – He flash – Horizontal Branch – Asymptotic giant – Planetary Nebula – White Dwarf
D. Subgiant – He flash – Red giant – Horizontal Branch – Asymptotic giant – Planetary Nebula – White Dwarf

Options :

28860716137. 1

28860716138. 2

28860716139. 3

28860716140. 4

Question Number : 48 Question Id : 2886074044 Question Type : MCQ Option Shuffling : No Correct Marks : 1 Wrong Marks : 0

There are two sunspots namely SS1 and SS2 on the surface of the Sun. The spectral energy density of SS1 peaks at 450 nm and that for SS2 peaks at 500 nm. Then

A. SS1 is hotter than SS2
B. SS1 is cooler than SS2
C. SS1 and SS2 will have same temperature
D. Nothing can be said about the temperature of SS1 and SS2

Options :

28860716141. 1

28860716142. 2

28860716143. 3

28860716144. 4

Question Number : 49 Question Id : 2886074045 Question Type : MCQ Option Shuffling : No Correct Marks : 1 Wrong Marks : 0

If V=10 mag, (B-V) = 0.5 mag and R_V = 3.2, then the value of the Wesenheit function is given by

A. 10.2 mag

B. 12.4 mag

C. 8.4 mag

D. 6.2 mag

Options :

28860716145. 1

28860716146. 2

28860716147. 3

28860716148. 4

Question Number : 50 Question Id : 2886074046 Question Type : MCQ Option Shuffling : No Correct Marks : 1 Wrong Marks : 0

Typical duration of star formation in a giant molecular cloud depends mainly on its

A. temperature

B. density and temperature

C. density

D. volume

Options :

28860716149. 1

28860716150. 2

28860716151. 3

28860716152. 4

Sub-Section Number:	3
Sub-Section Id:	28860752
Question Shuffling Allowed :	Yes

Question Id : 2886074047 Question Type : COMPREHENSION Sub Question Shuffling Allowed : Yes Group Comprehension Questions : No

Question Numbers : (51 to 75)

Question Label : Comprehension

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

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

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

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

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

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

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

$1yr = 3.154 \times 10^7 s$

Sub questions

Question Number : 51 Question Id : 2886074048 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

A star with a radius of 10^9 m and average magnetic field of 100 Gauss collapses to form a neutron star with a radius of 10 km. Estimate the magnetic field strength of the neutron star assuming magnetic flux is conserved during the collapse.

A. 10^{14} Gauss

B. 10^{10} Gauss

C. 10^{12} Gauss

D. 10^{07} Gauss

Options :

28860716153. 1

28860716154. 2

28860716155. 3

28860716156. 4

Question Number : 52 Question Id : 2886074049 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

What is the [Alpha/Fe] of bulge stars?

A. [Alpha/Fe] = 0.0

B. [Alpha/Fe] = -0.4

C. [Alpha/Fe] < 0.2

D. [Alpha/Fe] > 0.2

Options :

28860716157. 1

28860716158. 2

28860716159. 3

28860716160. 4

Question Number : 53 Question Id : 2886074050 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Find the surface gravity of a neutron star ($M = 1.4\ M_{\odot}$, $R = 10$ km) in terms of the surface gravity of the Earth.

A. $\sim 10^{10}$

B. $\sim 10^{11}$

C. $\sim 10^{12}$

D. $\sim 10^{13}$

Options :

28860716161. 1

28860716162. 2

28860716163. 3

28860716164. 4

Question Number : 54 Question Id : 2886074051 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Find the total energy release in a type-II supernova in which a neutron star ($M = 1.4\ M_{\odot}$, $R = 10$ km) is created.

A. ~ 10^{48} erg

B. ~ 10^{50} erg

C. ~ 10^{53} erg

D. ~ 10^{55} erg

Options :

28860716165. 1

28860716166. 2

28860716167. 3

28860716168. 4

Question Number : 55 Question Id : 2886074052 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

A neutron star of radius 10 km and surface dipole magnetic field strength of 10^{12} G is spinning on its axis once in 2π seconds. If the surrounding of the star is vacuum, then what would be the approximate magnitude of the electric field near the surface of the star?

A. 10^{8} V/m

B. 10^{10} V/m

C. 10^{12} V/m

D. 10^{14} V/m

Options :

28860716169. 1

28860716170. 2

28860716171. 3

28860716172. 4

Question Number : 56 Question Id : 2886074053 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

The density in the neutron star core is of the order

A. 10^{18} g/cc

B. 10^{15} g/cc

C. 10^{12} g/cc

D. 10^{8} g/cc

Options :

28860716173. 1

28860716174. 2

28860716175. 3

28860716176. 4

Question Number : 57 Question Id : 2886074054 Question Type : MCQ Option Shuffling : No Correct Marks : 1 Wrong Marks : 0

The Sun's rotation is

A. faster in the equator relative to the poles

B. faster in the poles relative to the equator

C. uniform from the pole to the equator

D. periodically faster or slower at the equator relative to the poles

Options :

28860716177. 1

28860716178. 2

28860716179. 3

28860716180. 4

Question Number : 58 Question Id : 2886074055 Question Type : MCQ Option Shuffling : No Correct Marks : 1 Wrong Marks : 0

Neutron stars probe which regime of nuclear matter?

A. High temperature - low energy

B. Low temperature - low energy

C. High temperature - high energy

D. Low temperature - high energy

Options :

28860716181. 1

28860716182. 2

28860716183. 3

28860716184. 4

Question Number : 59 Question Id : 2886074056 Question Type : MCQ Option Shuffling : No Correct Marks : 1 Wrong Marks : 0

The fastest known pulsar has a rotational frequency of approximately

A. 500 Hz

B. 700 Hz

C. 900 Hz

D. 1100 Hz

Options :

28860716185. 1

28860716186. 2

28860716187. 3

28860716188. 4

Question Number : 60 Question Id : 2886074057 Question Type : MCQ Option Shuffling : No Correct Marks : 1 Wrong Marks : 0

The transit method of exoplanet detection involves

A. measuring the precise position of the star and its variation

B. measuring the time variations of the star's rotation or pulsations

C. measuring the doppler shifts in the spectral lines of the star

D. measuring the dip in the brightness of the star

Options :

28860716189. 1

28860716190. 2

28860716191. 3

28860716192. 4

Question Number : 61 Question Id : 2886074058 Question Type : MCQ Option Shuffling : No Correct Marks : 1 Wrong Marks : 0

What are pulsar glitches?

A. sudden disappearance of pulsar's radio emission

B. sudden decrease in pulsar's period

C. sudden increase in pulsar's X-ray luminosity

D. sudden delay in the pulse time of arrival

Options :

28860716193. 1

28860716194. 2

28860716195. 3

28860716196. 4

Question Number : 62 Question Id : 2886074059 Question Type : MCQ Option Shuffling : No Correct Marks : 1 Wrong Marks : 0

What is the typical temperature of a white dwarf at birth?

A. 10^5 K

B. 10^7 K

C. 10^{10} K

D. 10^{12} K

Options :

28860716197. 1

28860716198. 2

28860716199. 3

28860716200. 4

Question Number : 63 Question Id : 2886074060 Question Type : MCQ Option Shuffling : No Correct Marks : 1 Wrong Marks : 0

The radial velocity method of exoplanet detection involves

A. measuring the precise position of the star and its variation

B. measuring the time variations of the star's rotation or pulsations

C. measuring the doppler shifts in the spectral lines of the star

D. measuring the dip in the brightness of the star

Options :

28860716201. 1

28860716202. 2

28860716203. 3

28860716204. 4

Question Number : 64 Question Id : 2886074061 Question Type : MCQ Option Shuffling : No Correct Marks : 1 Wrong Marks : 0

How does the electric conductivity in the crust change with density?

A. Decrease

B. Increase

C. Remains that same

D. Affected only if it exceeds a certain critical value

Options :

28860716205. 1

28860716206. 2

28860716207. 3

28860716208. 4

Question Number : 65 Question Id : 2886074062 Question Type : MCQ Option Shuffling : No Correct Marks : 1 Wrong Marks : 0

Multipolar surface fields are crucial in pulsars to explain

A. Spin-down

B. charge population in the magnetosphere

C. pair multiplication

D. polar cap heating

Options :

28860716209. 1

28860716210. 2

28860716211. 3

28860716212. 4

Question Number : 66 Question Id : 2886074063 Question Type : MCQ Option Shuffling : No Correct Marks : 1 Wrong Marks : 0

The rotating vector model fit to the pulsar's polarization position angle sweep shows that the magnetic field is

A. dipolar
B. quadrupolar
C. highly multipolar
D. Toroidal

Options :

28860716213. 1

28860716214. 2

28860716215. 3

28860716216. 4

Question Number : 67 Question Id : 2886074064 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Which of the following properties cannot be obtained from an exoplanet light curve?

A. Relative size of the planet
B. Mass of the planet
C. Orbital inclination
D. Orbital period

Options :

28860716217. 1

28860716218. 2

28860716219. 3

28860716220. 4

Question Number : 68 Question Id : 2886074065 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Ohmic dissipation occurs primarily in which part of the neutron star?

A. Crust
B. Envelope
C. Core
D. Core-crust boundary

Options :

28860716221. 1

28860716222. 2

28860716223. 3

28860716224. 4

Question Number : 69 Question Id : 2886074066 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Which of the following type of neutron stars is powered by magnetic field decay?

A. High mass X-ray binaries
B. Low mass X-ray binaries
C. Magnetars
D. Compact central objects

Options :

28860716225. 1

28860716226. 2

28860716227. 3

28860716228. 4

Question Number : 70 Question Id : 2886074067 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

The maximum radiative luminosity (Eddington limit) estimate for accretion onto a 1 solar mass object is of the order

A. 10^{30} erg/s
B. 10^{33} erg/s
C. 10^{36} erg/s
D. 10^{38} erg/s

Options :

28860716229. 1

28860716230. 2

28860716231. 3

28860716232. 4

Question Number : 71 Question Id : 2886074068 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Which exoplanet detection method is better suited for detecting Earth-like planets?

A. Transit method
B. Radial velocity method
C. Direct imaging
D. Astrometry

Options :

28860716233. 1

28860716234. 2

28860716235. 3

28860716236. 4

Question Number : 72 Question Id : 2886074069 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Why do pulsar periods show a bimodal distribution?

A. They are born either as fast or slow rotators
B. The magnetic field can either spin-up or spin-down the pulsar
C. Dynamical interaction with the binary can cause significant spin-down
D. Accretion in binaries can spin-up the pulsars

Options :

28860716237. 1

28860716238. 2

28860716239. 3

28860716240. 4

Question Number : 73 Question Id : 2886074070 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

The estimate of the surface magnetic field of millisecond pulsars is typically of the order

A. 10^8 G
B. 10^{10} G
C. 10^{12} G
D. 10^{14} G

Options :

28860716241. 1

28860716242. 2

28860716243. 3

28860716244. 4

Question Number : 74 Question Id : 2886074071 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Radiation from a typical young pulsar is dominant in which electro-magnetic band?

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

Options :

28860716245. 1

28860716246. 2

28860716247. 3

28860716248. 4

Question Number : 75 Question Id : 2886074072 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Habitable zone around a M-type star compared to the habitable zone for a Sun-like star is

A. at the same distance
B. closer
C. farther
D. does not depend on the spectral class

Options :

28860716249. 1

28860716250. 2

28860716251. 3

28860716252. 4

Sub-Section Number:	4
Sub-Section Id:	28860753
Question Shuffling Allowed :	Yes

Question Id : 2886074073 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 $c = 3 \times 10^8 ms^{-1}$
Planck's constant $h = 6.626 \times 10^{-34} J.s$
Gravitational constant $G = 6.674 \times 10^{-11} m^3 kg^{-1} s^{-2}$
Mass of proton $m_p = 1.673 \times 10^{-27} kg$
Mass of electron $m_e = 9.109 \times 10^{-31} kg$
Stefan-Boltzmann constant $\sigma = 5.670 \times 10^{-8} Jm^{-2} s^{-1} K^{-4}$
Boltzmann constant $k = 1.381 \times 10^{-23} JK^{-1}$
Mass of Sun $M_\odot = 1.989 \times 10^{30} kg$
Luminosity of Sun $L_\odot = 3.83 \times 10^{26}$ W
Radius of Sun $R_\odot = 6.96 \times 10^8$ m

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

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

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

$$1yr = 3.154 \times 10^7 s$$

Sub questions

Question Number : 76 Question Id : 2886074074 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

The theoretical Hayashi tracks in a Hertzsprung-Russell or HR diagram of a 5 $M_\odot$ star and a 0.5 $M_\odot$ star are

A. similar with both moving horizontally on the HR diagram maintaining a nearly constant luminosity
B. similar with both moving vertically down on the HR diagram decreasing in luminosity till it settles down on the main sequence
C. different with the 0.5 $M_\odot$ star maintaining a nearly constant temperature while that of the 5 $M_\odot$ star decreasing in luminosity till it reaches the main sequence
D. different with the 5 $M_\odot$ star maintaining a nearly constant luminosity while that of the 0.5 $M_\odot$ star decreasing in luminosity till it reaches the main sequence

Options :

28860716253. 1

28860716254. 2

28860716255. 3

28860716256. 4

Question Number : 77 Question Id : 2886074075 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Reflection nebulae appear blue because

A. they consist of very high temperature gas with a black body spectrum
B. they scatter light from nearby hot young stars
C. they scatter light from nearby relatively cold old stars
D. they are an aggregate of millions of hot young stars

Options :

28860716257. 1

28860716258. 2

28860716259. 3

28860716260. 4

Question Number : 78 Question Id : 2886074076 Question Type : MCQ Option Shuffling : No

Correct Marks : 1 Wrong Marks : 0

Which is the most important property of a star that determines its life cycle and ultimate fate?

A. Temperature

B. Radius

C. Colour

D. Mass

Options :

28860716261. 1

28860716262. 2

28860716263. 3

28860716264. 4

Question Number : 79 Question Id : 2886074077 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Considering that only 0.07 per cent of the mass of the Sun can be converted to energy by nuclear fusion, estimate how long will the Sun last?

A. 0.5 billion years

B. 5 billion years

C. 10 billion years

D. 15 billion years

Options :

28860716265. 1

28860716266. 2

28860716267. 3

28860716268. 4

Question Number : 80 Question Id : 2886074078 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

The core region of a supergiant consists of an Fe core surrounded by shells of different synthesized elements in the final stages. The shells as we go outwards from the core are

A. He, H, C and O, S and Si

B. C and O, S and Si, He, H

C. S and Si, O, C, He, H

D. C and O, S and Si, H, He

Options :

28860716269. 1

28860716270. 2

28860716271. 3

28860716272. 4

Question Number : 81 Question Id : 2886074079 Question Type : MCQ Option Shuffling : No Correct Marks : 1 Wrong Marks : 0

If the Sun were radiating by shrinking or converting its gravitational potential energy, how long would the Sun last?

A. 1.7 million years

B. 17 million years

C. 170 million years

D. 1700 million years

Options :

28860716273. 1

28860716274. 2

28860716275. 3

28860716276. 4

Question Number : 82 Question Id : 2886074080 Question Type : MCQ Option Shuffling : No Correct Marks : 1 Wrong Marks : 0

Which of the following statements regarding pressure inside a star is true?

A. Gas pressure and radiation pressure are equally important in low mass stars

B. Gas pressure is important in low mass stars and radiation pressure in high mass stars

C. Gas pressure is important in high mass stars and radiation pressure in low mass stars

D. Gas pressure and radiation pressure are equally important in high mass stars

Options :

28860716277. 1

28860716278. 2

28860716279. 3

28860716280. 4

Question Number : 83 Question Id : 2886074081 Question Type : MCQ Option Shuffling : No Correct Marks : 1 Wrong Marks : 0

Estimate the average pressure inside the Sun, which is hydrostatic equilibrium.

A. 9×10^{11} Pa

B. 9×10^{13} Pa

C. 9×10^{15} Pa

D. 9×10^{17} Pa

Options :

28860716281. 1

28860716282. 2

28860716283. 3

28860716284. 4

Question Number : 84 Question Id : 2886074082 Question Type : MCQ Option Shuffling : No Correct Marks : 1 Wrong Marks : 0

Two stars are close together and they have the same brightness, where each star has a magnitude of +8·5. The magnitude of the combined stellar system is

A. 8.50

B. 7.75

C. 17.00

D. 4.25

Options :

28860716285. 1

28860716286. 2

28860716287. 3

28860716288. 4

Question Number : 85 Question Id : 2886074083 Question Type : MCQ Option Shuffling : No Correct Marks : 1 Wrong Marks : 0

The distance modulus to a star is 12.386. The distance to the star is

A. 1 kpc

B. 7 kpc

C. 5 kpc

D. 3 kpc

Options :

28860716289. 1

28860716290. 2

28860716291. 3

28860716292. 4

Question Number : 86 Question Id : 2886074084 Question Type : MCQ Option Shuffling : No Correct Marks : 1 Wrong Marks : 0

A star is found to have luminosity that is 1500 times that of the Sun. If its effective temperature is 6500 K, then its radius (in terms of solar radius) is

A. 25

B. 2.5

C. 250

D. 0.25

Options :

28860716293. 1

28860716294. 2

28860716295. 3

28860716296. 4

Question Number : 87 Question Id : 2886074085 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

The value of the effective temperature of the star is obtained by

A. fitting blackbody model to the surface spectrum

B. fitting blackbody model to the spectrum of the core of the star

C. calculating the depth of the absorption lines

D. measuring the average velocities of molecules on the surface of the star

Options :

28860716297. 1

28860716298. 2

28860716299. 3

28860716300. 4

Question Number : 88 Question Id : 2886074086 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Luminosity class III represents

A. supergiants

B. bright giants

C. subdwarfs

D. giants

Options :

28860716301. 1

28860716302. 2

28860716303. 3

28860716304. 4

Question Number : 89 Question Id : 2886074087 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

KH time scale of a solar type star is

A. About $3x10^3$ years

B. About $3x10^5$ years

C. About $3x10^7$ years

D. About $3x10^9$ years

Options :

28860716305. 1

28860716306. 2

28860716307. 3

28860716308. 4

Question Number : 90 Question Id : 2886074088 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

Colour-magnitude diagram of a star cluster is equivalent to the HR diagram of field star because all members of a star cluster have

A. similar evolutionary stage

B. similar reddening

C. similar distance

D. similar mass

Options :

28860716309. 1

28860716310. 2

28860716311. 3

28860716312. 4

Question Number : 91 Question Id : 2886074089 Question Type : MCQ Option Shuffling : No

Correct Marks : 1 Wrong Marks : 0

Coronal Mass Ejections from the Sun

A. are the same as flares

B. are due to magnetic fields in the corona getting destabilized

C. originate only from the poles of the Sun

D. are observed only during the solar minima

Options :

28860716313. 1

28860716314. 2

28860716315. 3

28860716316. 4

Question Number : 92 Question Id : 2886074090 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

The time of sunset 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 :

28860716317. 1

28860716318. 2

28860716319. 3

28860716320. 4

Question Number : 93 Question Id : 2886074091 Question Type : MCQ Option Shuffling : No
Correct Marks : 1 Wrong Marks : 0

The coordinate of an object on the celestial sphere is defined by

A. two angles and the distance

B. one angle, the distance and the proper motion of the object

C. two angles

D. two angles and the motion of the object

Options :

28860716321. 1

28860716322. 2

28860716323. 3

28860716324. 4

Question Number : 94 Question Id : 2886074092 Question Type : MCQ Option Shuffling : No Correct Marks : 1 Wrong Marks : 0

The declination of the Sun

A. depends on the latitude of Earth

B. depends on the distance of the Earth from the Sun

C. remains constant throughout the year

D. is the same as measured from the two poles of the Earth

Options :

28860716325. 1

28860716326. 2

28860716327. 3

28860716328. 4

Question Number : 95 Question Id : 2886074093 Question Type : MCQ Option Shuffling : No Correct Marks : 1 Wrong Marks : 0

The measurement of Sun's temperature

A. is a function of the distance of the Earth from the Sun

B. changes as the Earth rotates

C. determines the colour of the Sun that we see from Earth

D. depends on the season of the Earth

Options :

28860716329. 1

28860716330. 2

28860716331. 3

28860716332. 4

Question Number : 96 Question Id : 2886074094 Question Type : MCQ Option Shuffling : No Correct Marks : 1 Wrong Marks : 0

The effective temperature of the surface of the Sun is

A. 2885 Kelvin

B. 4290 Kelvin

C. 5780 Kelvin

D. 7550 Kelvin

Options :

28860716333. 1

28860716334. 2

28860716335. 3

28860716336. 4

Question Number : 97 Question Id : 2886074095 Question Type : MCQ Option Shuffling : No Correct Marks : 1 Wrong Marks : 0

The stars belonging to the same constellation

A. are of same spectral class

B. need not be at the same distance from the Earth

C. move with the same proper velocity

D. are of the same age

Options :

28860716337. 1

28860716338. 2

28860716339. 3

28860716340. 4

Question Number : 98 Question Id : 2886074096 Question Type : MCQ Option Shuffling : No Correct Marks : 1 Wrong Marks : 0

Which of the following statements is correct?

A. The equatorial co-ordinates of stars remain constant at different latitudes on Earth at any given instant of time

B. The horizontal co-ordinates of stars remain constant at different latitudes on Earth at any given instant of time

C. The star Polaris will remain at the North Celestial Pole even after 5000 years

D. Precession of Earth's rotation occurs because of Sun's motion around the Galactic centre

Options :

28860716341. 1

28860716342. 2

28860716343. 3

28860716344. 4

Question Number : 99 Question Id : 2886074097 Question Type : MCQ Option Shuffling : No Correct Marks : 1 Wrong Marks : 0

The zenith of an observer

A. is the same as the nadir if the observer is at the south pole

B. is aligned with the north pole if the observer is at the equator

C. is aligned with the north pole if the observer is at the north pole

D. is perpendicular to the north pole if the observer is at the north pole

Options :

28860716345. 1

28860716346. 2

28860716347. 3

28860716348. 4

Question Number : 100 Question Id : 2886074098 Question Type : MCQ Option Shuffling : No Correct Marks : 1 Wrong Marks : 0

A star at a distance of 25 parsec will subtend a parallax of

A. 0.4 arcseconds

B. 0.25 arcseconds

C. 0.04 arcseconds

D. 0.025 arcseconds

Options :

28860716349. 1

28860716350. 2

28860716351. 3

28860716352. 4