National Testing Agency

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Astronomy and Astrophysics

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Astronomy and Astrophysics

Section Id :	489994239
Section Number :	1
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Section Marks:	100
Display Number Panel:	Yes
Group All Questions:	No

Sub-Section Number:	1
Sub-Section Id:	489994256
Question Shuffling Allowed :	Yes

Question Number : 1 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

To observe the motions of stars very close to the centre of the Milky way galaxy, one needs to use telescopes enabled with adaptive optics because

A. the atmosphere blurs images making it difficult to determine their positions accurately
B. the dust in the plane of the Milky Way will obscure them
C. the central stars are too faint to be observed with conventional telescopes
D. the central stars move too fast to be observed with conventional telescopes

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 2 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Which of the following component in galaxies do not contribute to the cosmic baryon budget of the Universe?

A. Brown dwarfs
B. Neutral hydrogen-emitting cold gas
C. Molecular clouds
D. Neutrinos

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 3 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

The X-ray luminosities of active galactic nuclei are found to range from about 10^{41} to 10^{49} ergs s^{-1}. These high luminosities are believed to be due to

A. intense bursts of star formation
B. nuclear reactions in the nuclei of active galaxies
C. accretion on to a supermassive black hole
D. emission from dense nebulae in the nuclear regions

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 4 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

The observation for extremely hot corona of the Sun came about due to the detection of

A. Fe XIV line

B. Li II line

C. H II line

D. He II line

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 5 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

What is the typical strength of magnetic fields in solar quiet corona?

A. ~100 gauss

B. ~10 gauss

C. ~10,000 gauss

D. ~10,00 gauss

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 6 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Celestial radio sources are not observed from the Earth at about 1 MHz because

A. electromagnetic radiation at these low frequencies are not emitted by celestial radio sources
B. these low-frequency waves are absorbed by the atmosphere
C. these low-frequency waves are blocked by the ionosphere
D. of a lot of man-made radio frequency interference (RFI) at these low frequencies

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 7 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

The frequency of gravitational wave emitted by a binary system is

A. same as the orbital frequency of the binary stars
B. twice that of the orbital frequency of the binary stars
C. four times that of the orbital frequency of the binary stars
D. half of the orbital frequency of the binary stars

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 8 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

The first ever direct detected gravitational source by LIGO consists of

A. two supermassive coalescing black holes
B. two coalescing neutron stars
C. a system with one neutron star coalescing with a supermassive blackhole
D. two stellar mass coalescing blackholes

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 9 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

One of the following is NOT a source of gravitational waves:

A. blackhole in close binary

B. supernova explosion

C. the radial collapse of a spherical star

D. big bang

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 10 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

The quasi normal modes (QNM) of black holes can be used to

A. to determine what happens to materials entered into the blackhole

B. test theories of gravity and the existence of black holes

C. to integrate the field equations near blackhole

D. to show the existence to dark-matter

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 11 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

The scale factor $a(t)$ in a matter-dominated universe evolves as

A. $a(t) \propto t^2$

B. $a(t) \propto t$

C. $a(t) \propto t^{1/2}$

D. $a(t) \propto t^{2/3}$

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 12 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

The Hubble- Lemaître law states that the velocity of recession of galaxies due to the cosmological expansion of the Universe is proportional to the

A. square of the distance to the galaxies

B. square root of the distance to the galaxies

C. distance to the galaxies

D. cube root of the distance to the galaxies

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 13 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

'Numpy' is a Python module for

A. plotting numerical data

B. numerical modelling of galaxy formation

C. obtaining fast Fourier transforms of data

D. fast array processing

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 14 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

The Pyraf package can be used for the analysis of

A. optical data

B. radio data

C. X-ray data

D. gravitational wave observations

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 15 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

The imaging footprint of the Sloan Digital Sky Survey now covers about

A. 1/100 of the whole sky

B. 1/10 of the whole sky

C. 1/3 of the whole sky

D. The whole sky

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 16 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Messier constructed his catalogue of nebulous objects in order to

A. identify fuzzy objects that could easily be confused for comets by comet hunters

B. identify the brightest galaxies in the sky

C. identify emission line nebulae suitable for further study

D. estimate the size and distribution of spiral arms in our galaxy

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 17 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Supernovae are classified based on

A. amount of energy released

B. spectral features seen in optical light

C. brightness

D. host galaxy

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 18 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Which of the following statements about the Hawking temperature of black holes is true?

A. Heavier black holes have smaller Hawking temperature
B. Lighter black holes have smaller Hawking temperature
C. Hawking temperature is independent of the black hole mass
D. Hawking temperature depends on the way the black hole is formed

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 19 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

What does active optics help to do?

A. Reduce the broadening effect of the atmosphere
B. Operate the mount of the telescope properly to point it precisely in the required direction
C. Allow a telescope to follow a star by compensating for the Earth's rotation
D. Keep correctly aligned the segments of the mirror of a telescope

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 20 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

For a virial system, the average values of the total energy E, the potential energy U and kinetic energy K are related by

A. $E = U/2$
B. $E = 2U$
C. $E = K$
D. $E = K/2$

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 21 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

The energy radiated by a radio pulsar comes primarily at the cost of its

A. gravitational energy

B. thermal energy

C. magnetic energy

D. rotational energy

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 22 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

. Before nuclear burning starts, a protostar contracts at a rate determined by

A. the pull of gravity

B. the radiation from the surface

C. evolution of composition

D. hydrogen fusion probability

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 23 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Which of the following uses timing domain analysis:

A. Calculation of Hubble's constant using recession velocities of galaxies and distance

B. Calculation of Hubble's constant using gravitational lensing

C. Calculation of elemental composition of stars and galaxies

D. Determination of velocity width of broad lines in spectra of Seyfert galaxies

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 24 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Which of the following is correct about atmospheric extinction?

A. Extinction of star decreases as the star rises and moves towards the zenith

B. Extinction of star increases as the star rises and moves towards the zenith

C. Extinction of star remains the same as the star rises and moves towards the zenith

D. Extinction of star decreases as the star moves towards the west while setting

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 25 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

A laser guide star is insensitive to tip-tilt mode of the atmosphere whereas a natural guide star is, because

A. a natural guide star is far away from the object being imaged

B. a laser guide star goes through a different patch of atmosphere compared to the natural guide star

C. a laser guide star goes through a length of atmosphere and back and so the effect of tip-tilt cancels

D. a natural guide star goes through a length of atmosphere and back and so the effect of tip-tilt cancels

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 26 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

The hot intergalactic medium of a galaxy cluster emits soft X-rays mainly due to

A. blackbody radiation

B. inverse Compton scattering

C. thermal Bremsstrahlung radiation

D. the Sunyaev-Zel'dovich effect

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 27 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Which part of the profile of the broad iron line in an active galactic nucleus helps in determining the spin of a black hole?

A. The blue wing of the iron line

B. The width of the iron line

C. The peak of the iron line

D. The red wing of the iron line

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 28 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

To compute the interquartile range, the statistical average that is used is

A. mean

B. mode

C. median

D. either mode or mean

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 29 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

An observer traveling in a spacecraft fitted with very power rockets enters the event horizon of a Schwarzschild black hole so that his radial coordinate $r < R_s \equiv \frac{2GM}{c^2}$. The Schwarzschild space-time is described by the line-element,

$$ds^2 = c^2\left(1 - \frac{R_s}{r}\right)dt^2 - \frac{dr^2}{1-\frac{R_s}{r}} - r^2(d\theta^2 + sin^2\theta d\varphi^2).$$

Then, the observer:

A. cannot have a θ = constant trajectory because it is time-like for $r < R_s$

B. cannot have a r = constant trajectory because it is space-like for $r < R_s$

C. cannot have a φ = constant trajectory because it is space-like for $r < R_s$

D. can have a r = constant trajectory because it is time-like for $r < R_s$

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 30 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

The twinkling of stars is attributed to the broadening effect on images. Why do planets not twinkle?

A. Because the photons from the planets are not affected by the atmosphere

B. Planets are far less massive than stars

C. Planets move in elliptical orbits around the Sun

D. Planets are optically resolved objects

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 31 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Consider a solar mass star orbiting the 4×10^6 solar mass black hole at the centre of our Galaxy in a circular face-on orbit, once every 4 years. The radius of the orbit is

A. 4×10^6 pc

B. 0.002 pc

C. 0.006 pc

D. 2 pc

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 32 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

The weak magnetic field frozen/embedded within the solar wind plasma

A. is effective in excluding some low-energy cosmic rays from the solar system and in guiding energetic particles from the Sun into the heliosphere
B. is effective in allowing some low-energy cosmic rays to the solar system and in scattering energetic particles from the Sun into the heliosphere
C. has effects only very close to the Sun
D. can increase in strength with distance from the Sun

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 33 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

The primary soft X-ray emission mechanism in accreting stellar mass black hole systems is thought to be

A. synchrotron emission
B. curvature radiation
C. blackbody radiation
D. Compton scattering

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 34 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

The light curve of a supernova typically lasts for

A. centuries

B. days

C. tens of years

D. milli seconds

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 35 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Among the following ISRO missions, the mission that discovered the presence of water on moon is

A. Chandrayaan-2

B. Astrosat

C. Mars Orbiter Mission

D. Chandrayaan-1

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 36 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

With reference to the electromagnetic spectrum, state the correct statement

A. an object emitting predominantly in the infra-red is hotter than red hot iron

B. decreasing frequency is correlated to decreasing wavelength

C. ultra-violet emitters are at higher temperature than radio emitters

D. increasing wavelength is correlated to increasing energy

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 37 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

Which of the following methods of measuring the amount of dark matter in a galaxy cluster does not require the cluster to be in some form of equilibrium?

A. weak gravitational lensing

B. soft X-ray emission from the intracluster medium

C. random motion of galaxies

D. the Sunyaev-Zel'dovich effect

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 38 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

The Seyfert galaxies are named after Carl Seyfert who first drew attention to this class of objects. Seyfert galaxies are classified into Seyfert 1 and Seyfert 2. The Seyfert 1 galaxies are characterised by the presence of

A. only narrow emission lines

B. both narrow emission lines and broad emission lines

C. only broad emission lines

D. only absorption lines and no emission lines

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 39 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

In Astrosat the detector covering the electromagnetic range from 3 to 80 keV is

A. UVIT

B. SXT

C. SSM

D. LAXPC

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 40 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 1 Wrong Marks : 0

With reference to our solar system, choose the correct statement.

A. Ceres is a dwarf planet

B. The asteroid belt does not have any dwarf planet

C. Mercury and Venus are gaseous planets

D. Neptune does not have any satellite

Options :

1. 1
2. 2
3. 3
4. 4

Sub-Section Number:	2
Sub-Section Id:	489994257
Question Shuffling Allowed :	Yes

Question Number : 41 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0

The Sun is in a circular orbit going around the centre of the Milky Way galaxy at a distance of 8 kpc from it, at an average speed of 220 km s^{-1}. If the age of the Sun is 4.5×10^9 yr, approximately how many orbits has it completed about the centre of the Galaxy?

A. less than 1

B. 10

C. 20

D. 50

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 42 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0

A star orbits the central black hole of the Milky Way galaxy with an orbital period of 15.2 years and an orbital radius of 0.015 ly. Assuming it is on a circular orbit, and its motion is entirely due to the central black hole, the black hole's mass can be estimated to be

A. 100 million solar masses

B. 50 million solar masses

C. 20 million solar masses

D. 4 million solar masses

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 43 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0

Inverse-Compton scattering is prevalent in a number of astrophysical situations including the nuclear regions and extended lobes of radio sources. A photon of frequency 1 GHz which is inverse-Compton scattered by relativistic electrons with a Lorentz factor of 10^4, would have a frequency

A. 10^{17} Hz

B. 10^{22} Hz

C. 10^{13} Hz

D. 10^{19} Hz

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 44 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0

The separation between the two lobes of Cygnus A is roughly 2 arcminutes. Assuming that we can tell them apart as distinct objects with a resolution that is half as much, how big should a radio dish operating at 1.4 GHz be?

A. 737 m

B. 737 km

C. 13 m

D. 13 km

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 45 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0

Compute the effective temperature of a star given the luminosity is 3.8×10^{33} ergs s^{-1}, $R = 6.95 \times 10^5$ km and Stefan-Boltzmann constant is 5.67×10^{-5} ergs cm^{-2} s^{-1} K^{-4}.

A. 10,000 K

B. 10,00,000 K

C. 6,000 K

D. 1,50,00,000 K

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 46 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0

The f-mode oscillations of the Sun correspond to what value of n (radial node)?

A. All nodes > 0

B. 0

C. 2

D. 5

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 47 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0

During the last phase of in-spiral of a binary neutron star system, based on the deformation of stars, it is possible to determine

A. what the stars are made up of or equation of state for neutron stars

B. the density of the Universe including the dark matter and dark energy

C. the cosmological constant

D. universal gravitational constant G

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 48 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0

For a jet moving at 0.99c and at an angle of 5° to the line of sight, the apparent velocity of the jet will be

A. 0.80c

B. 0.99c

C. 2.00c

D. 6.3c

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 49 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0

Consider a massless scalar field propagating in de Sitter inflation with a constant Hubble parameter H. In such a case, the amplitude of the scale invariant power spectrum associated with the scalar field depends on H as

A. H

B. H^2

C. $1/H$

D. $1/H^2$

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 50 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0

Consider a scalar field of mass m evolving in a Friedmann universe. In such a case, which of the following statements would be true?

A. Particles of all energies are created by the background

B. Only particles with energies greater than m are created

C. Only particles with energies smaller than m are created

D. Since the field has mass, no particles are created at all

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 51 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0

In an elliptical galaxy, if the radial velocity profile of stars is seen to increase as $\sqrt{R}$, where R is the radius, then the stellar density profile goes as

A. constant

B. $\frac{1}{\sqrt{R}}$

C. $\frac{1}{R}$

D. $\sqrt{R}$

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 52 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0

A radio telescope is observing the HI line at 1420 MHz with a bandwidth of 32 MHz divided into 4096 channels. The velocity resolution obtained is

A. $73.2\ \mathrm{km\ s^{-1}}$

B. $1.7\ \mathrm{km\ s^{-1}}$

C. $23.4\ \mathrm{km\ s^{-1}}$

D. $0.1\ \mathrm{km\ s^{-1}}$

Options :

1. 1

2. 2
3. 3
4. 4

Question Number : 53 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical
Correct Marks : 2 Wrong Marks : 0

Which of these is true?

A. All spiral and elliptical galaxies form independently
B. Most spirals are formed from elliptical galaxies flattening due to rotation
C. Most ellipticals are formed from spiral galaxies through mergers
D. Spirals and ellipticals can evolve into ellipticals and spirals respectively

Options :
1. 1
2. 2
3. 3
4. 4

Question Number : 54 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical
Correct Marks : 2 Wrong Marks : 0

If all stars were the size of the Sun (radius of 7, 00, 000 km), and the typical radius of a galaxy is 30 kpc with an average of 1 galaxy every Mpc^3, then how many star would you need in a 1 pc^3 volume for the mean free paths of stars and galaxies to be equal?

A. 1.8×10^6
B. 1.3×10^{-6}
C. 5.7×10^{-7}
D. 1.6×10^5

Options :
1. 1
2. 2
3. 3
4. 4

Question Number : 55 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical
Correct Marks : 2 Wrong Marks : 0

The radial flow of solar wind co-rotates with the Sun. Therefore, there must be an interaction (co-rotating interaction region, CIR) between fast and slow flows, because plasma from the fast wind will catch up with and overtake plasma from the slow wind. Most CIRs form shocks at about 1 to 2 AU. For a given difference in speeds between slow and fast flows, if the angular velocity of the Sun is reduced to half, what is the typical distance range of shock formation?

A. Below 0.5 AU

B. At about 0.5 to 1 AU

C. At about 1 to 2 AU

D. Above 2 AU

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 56 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0

The standard white dwarf cooling law may be written as temperature T proportional tot$^{\alpha}$, where t is the age of the white dwarf. The exponent α has a value

A. $-2/5$

B. $-5/2$

C. $-5/7$

D. $-7/2$

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 57 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0

How much will the Chandrasekhar limit be if a white dwarf is formed entirely of hydrogen?

A. 0.7 solar mass

B. 1.4 solar mass

C. 2.8 solar mass

D. 5.6 solar mass

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 58 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0

At very high density n-p-e matter, the proton fraction approaches the value

A. 12%

B. 7%

C. 1%

D. zero

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 59 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0

The estimated escape velocity from the surface of a 1 solar mass white dwarf is about

A. 60 km s^{-1}

B. 500 km s^{-1}

C. 7,000 km s^{-1}

D. 3,00,000 km s^{-1}

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 60 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0

The ratio of gravitational binding energy to the rest energy of matter on the surface of a 1.5 solar mass neutron star is approximately

A. 2.0

B. 0.2

C. 0.6

D. 0.01

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 61 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0

Given that the Eddington luminosity is $1.3 \times 10^{38} \left(\frac{M}{M_{\odot}}\right) ergs\ s^{-1}$, estimate the temperature for a one solar mass neutron star radiating at the Eddington luminosity.

A. 10^5 K

B. 10^9 K

C. 10^3 K

D. 10^7 K

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 62 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0

Which of these statements are false?

A. The size scale over which the rms phase fluctuation is small is different for blue and red light

B. If the atmospheric turbulence does not change its parameters during the night (that is, you freeze the atmosphere motion), then the resolution obtained by a telescope will also be constant as it tracks the star from rise to set

C. The value of the structure function changes with height of the atmosphere

D. The Fried parameter includes the effect of turbulence along the entire path through the atmosphere

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 63 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0

If relativistic electrons in the intra-cluster medium would propagate only by diffusion, then they can maximally move with Alfven speed, v_A, given by,

$$v_A = 2.2 \times B_{[\mu G]} \times n_{e[cm^{-3}]}^{-1/2}\ km\ s^{-1}$$

where B is the magnetic field and n_e is the ambient electron density. How far can a relativistic electron reach within its radiative lifetime of 10^8 yr, assuming that it travels with v_A in a medium with a magnetic field of $1\mu G$ and an electron density of $0.001\ cm^{-3}$?

A. 100 kiloparsec

B. 70 kiloparsec

C. 7 kiloparsec

D. 5 kiloparsec

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 64 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0

Astronomers have detected redshifted H_α absorption line from the surface region of a white dwarf (WD) of mass 1 $M_\odot$ and radius 6,000 km. The rest wavelength of H_α line is $\lambda_{em} = 656.28$ nm. If the white dwarf is at a distance of about 10^{18} m from the Earth, and the space-time geometry around the WD is described by the line-element,

$$ds^2 = c^2\left(1 - \frac{2GM}{rc^2}\right)dt^2 - \frac{dr^2}{1-\frac{2GM}{rc^2}} - r^2(d\theta^2 + sin^2\theta d\varphi^2),$$

the observed fractional change in the wavelength, $\frac{\lambda_{obs}}{\lambda_{em}} - 1$, caused by the WD due to the gravitational redshift is about,

A. 7.5×10^{-4}

B. 2.5×10^{-4}

C. 3.5×10^{-5}

D. 1.5×10^{-3}

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 65 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0

If $\Gamma^\alpha_{\mu\nu}$ is the Christoffel symbol corresponding to the metric tensor $g_{\mu\nu}$ and $\bar{\Gamma}^\alpha_{\mu\nu}$ is the Christoffel symbol corresponding to another metric tensor $\bar{g}_{\mu\nu}$, then,

A. $\bar{\Gamma}^\alpha_{\mu\nu} - \Gamma^\alpha_{\mu\nu}$ is a third rank tensor

B. $\bar{\Gamma}^\alpha_{\mu\nu} - \Gamma^\alpha_{\mu\nu} = 0$

C. $\bar{\Gamma}^\alpha_{\mu\nu}$ is related to $\Gamma^\alpha_{\mu\nu}$ in terms of an inhomogeneous coordinate transformation

D. $\bar{g}^{\mu\nu}\bar{\Gamma}^\alpha_{\mu\nu} = g^{\mu\nu}\Gamma^\alpha_{\mu\nu}$

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 66 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0

Given two point masses, m_1 and m_2, moving in the x-y plane in circular orbits around the common centre of mass because of their mutual gravitational attraction (Assume Newtonian gravity). If L represents the distance between m_1 and m_2, and $\mu = \frac{m_1 m_2}{m_1+m_2}$ is the reduced mass, then the mass quadrupole moments are given by,

A. $Q_{xx} = \frac{1}{2} m_1^2 L^2 (1 + cos2\psi)$,

$Q_{yy} = \frac{1}{2} m_2^2 L^2 (1 - cos2\psi)$,

$Q_{xy} = m_1 m_2 L^2 sin2\psi = Q_{yx}$,

where $\psi = \sqrt{\frac{G(m_1 m_2)}{(m_1+m_2)L^3}} t + constant$

B. $Q_{xx} = \frac{1}{2} m_1 L^2 (1 + cos2\psi)$,

$Q_{yy} = \frac{1}{2} m_2 L^2 (1 - cos2\psi)$,

$Q_{xy} = (m_1 + m_2) L^2 sin2\psi = Q_{yx}$,

where $\psi = \sqrt{\frac{G(m_1 m_2)}{\mu^2 L^3}} t + constant$

C. $Q_{xx} = \frac{1}{2} \mu L^2 (1 + cos2\psi)$,

$Q_{yy} = \frac{1}{2} \mu L^2 (1 - cos2\psi)$,

$Q_{xy} = \mu L^2 sin2\psi = Q_{yx}$,

where $\psi = \sqrt{\frac{G\mu}{L^3}} t + constant$

D. $Q_{xx} = \frac{1}{2} \mu L^2 (1 + cos2\psi)$,

$Q_{yy} = \frac{1}{2} \mu L^2 (1 - cos2\psi)$,

$Q_{xy} = \mu L^2 sin2\psi = Q_{yx}$,

where $\psi = \sqrt{\frac{G(m_1+m_2)}{L^3}} t + constant$

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 67 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0

In the weak field approximation, $g_{\mu\nu} = \eta_{\mu\nu} + h_{\mu\nu}$ and $g^{\mu\nu} = \eta^{\mu\nu} + h^{\mu\nu}$ with $|h_{\mu\nu}| \ll 1$ and $|h^{\mu\nu}| \ll 1$. Then, upto linear orders in $h_{\mu\nu}$, one can show that,

A. $\eta_{\alpha\nu}h^{\mu\alpha} = \eta^{\mu\alpha}h_{\alpha\nu}$

B. $h_{\mu\nu} = \eta_{\mu\alpha}\eta_{\nu\beta}h^{\alpha\beta}$

C. $\eta_{\alpha\nu}h^{\mu\alpha} = -\eta^{\mu\alpha}h_{\alpha\nu}$

D. $\eta^{\mu}_{\nu}h_{\mu\alpha} = h^{\nu}_{\alpha}$

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 68 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0

. Synchrotron emission from ultra-relativistic electrons are seen in a number of astrophysical sources such as the jets and lobes of radio galaxies, as well as supernova remnants and exotic stellar sources. For an ultra-relativistic electron travelling with a Lorentz factor of 10^4, what would be the half angle of the forward emitting cone of emission?

A. 3.5 arcmin

B. 2.8 degrees

C. 0.0054 arcmin

D. 0.34 arcmin

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 69 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0

The angular separation $\Delta\theta(z = 0.2)$ between the radio lobes of a radio-galaxy located at a redshift $z = 0.2$, is observed to be 8 arc-sec. Suppose the same radio-galaxy, along with its associated radio-structure, is placed at different redshifts as a computer exercise, then, assuming that the luminosity-distance is given by, $D_L(z) = \frac{2c}{H_0}\left[1 + z - \sqrt{1+z}\right]$, the redshift at which $\Delta\theta(z)$ will be the least is given by,

A. $z = \infty$

B. $z = 1.25$

C. $z = 2.25$

D. $z = 3.5$

Options :

1. 1
2. 2
3. 3
4. 4

Question Number : 70 Question Type : MCQ Option Shuffling : No Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0

A test particle of rest mass m_0 held by a strong wire is very slowly lowered from a radius r_i to a radius r_f towards a Schwarzschild black hole of mass M that is described by the line-element,

$$ds^2 = c^2\left(1 - \frac{2GM}{rc^2}\right)dt^2 - \frac{dr^2}{1-\frac{2GM}{rc^2}} - r^2(d\theta^2 + sin^2\theta d\varphi^2).$$

Then, in this process,

A. one has to spend $m_0c^2\left(\sqrt{1-\frac{2GM}{c^2r_i}} - \sqrt{1-\frac{2GM}{c^2r_f}}\right)$ amount of energy

B. the energy extracted is $m_0c^2\left(\sqrt{1-\frac{GM}{c^2r_i}} - \sqrt{1-\frac{GM}{c^2r_f}}\right)$

C. one has to spend $m_0c^2\left(\sqrt{1-\frac{GM}{c^2r_i}} - \sqrt{1-\frac{GM}{c^2r_f}}\right)$ amount of energy

D. the energy extracted is $m_0c^2\left(\sqrt{1-\frac{2GM}{c^2r_i}} - \sqrt{1-\frac{2GM}{c^2r_f}}\right)$

Options :

1. 1
2. 2
3. 3
4. 4