MENTAL ABILITY

1. If BINARY is coded as DHPZTX then how will KIDNAP be coded?

(1) MKFPCQ

(2) MHFPZQ

(3) IKFMYO

(4)*MHFMCO

2. If Sand is coded as Brick, Brick as House, House as Temple, Temple as Palace then where do you worship?

(1)*Palace

(2) Temple

(3) Brick

(4) House

3. If the following words are arranged according to the dictionary order then which will be the second word in that order?

(1) Expound

(2) Exposure

(3) Expulsion

(4)*Expose

4. In a certain code language '579' means—'Kanchan is soft-spoken', '694' means—'Soft-spoken beautiful pure', '473' means—'Ganga is pure', then what is the code used for 'Kanchan'?

(1) 7 (2)*5

(3) 9 (4) 10

5. In the following question one word is different from the rest. Find out the word which does not belong to the group.

(1) GTSH (2) BYXC

(3)*ETUF (4) LONM

6. Six people P, Q, R, S, T and U are sitting in a circular path who are facing the centre. R is third from P in the right. Q is third from T in the left. U is between P and T and S is third from U in the left right. Who is opposite to T?

(1) S (2)*Q

(3) P (4) U

7. Five members of a family, Rakesh, Mukesh, Roopesh, Vipul and Umesh take food in a definite order—

(A) Umesh was next to first man.

(B) Roopesh took food after the man who was before Vipul.

(C) Rakesh was the last man to take food.

Who were the first and last men to take food?

(1) Mukesh and Roopesh

(2) Roopesh and Rakesh

(3) Umesh and Mukesh

(4)*Mukesh and Rakesh

8. Suresh walked 10 m towards West from his house. Then he walked 5 m turning to his left. After this he walked 10 m turning to his left and in the end he walked 10 m turning to his left. In what direction is he now from his starting point?

(1) South (2)*North

(3) East (4) West

9. If the following numbers are written in descending order then what will be the middle digit of the middle term?

723, 789, 595, 659, 713, 785, 689

(1)*1 (2) 7

(3) 8 (4) 3

10. A bus for Bombay leaves after every forty minutes from a bus stand. An enquiry clerk told a passenger that the bus had already left ten minutes ago and the next bus will leave at 10.45 a.m. At what time did the enquiry clerk give this information to the passenger?

(1) 10.05 a.m. (2) 9.55 a.m.

(3) 10.35 a.m. (4)*10.15 a.m.

11. When astronomers look at distant galaxies, what sort of motion do they see?

(1) The galaxies are all spinning rapidly.

(2) The galaxies are all moving rapidly toward us.

(3)*The galaxies are all moving rapidly away from us.

(4) Galaxies are falling toward three centres in opposite parts of the sky.

12. What is meant by the redshift?

(1) The galaxies are growing redder as we watch.

(2) The galaxies are cooling off.

(3)*The spectrum lines of the galaxies are shifted to redder wavelengths.

(4) Only (1) and (2)

13. What do astronomers infer from the motion of the distant galaxies?

(1) The Universe is contracting.

(2)*The Universe is expanding.

(3) The Universe is imploding.

(4) The Universe is spinning.

14. Astronomers have found the cosmic microwave background (CMB) radiation. What is the nature of this radiation?

(1) It is a bright, uniform, X-ray glow.

(2)*It is a faint, uniform, radio signal.

(3) It is a faint, uniform, X-ray glow.

(4) It is a weak and very patchy glow at visible wavelengths.

15. How was the cosmic microwave background created?

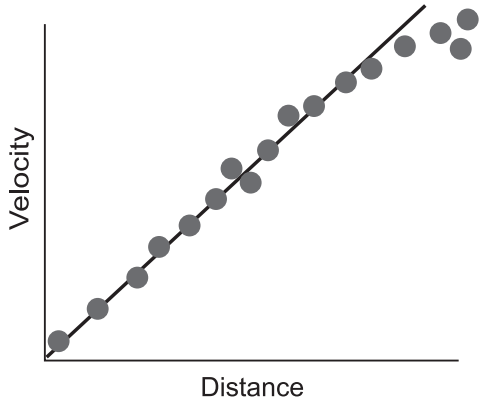
(1) The fusion of H into He by the first stars.

(2) The radioactive decay of uranium.

(3) The formation of quarks in the big bang.

(4)*The burst of radiation from the big bang as it cooled toward 10,000 K.

16. The sketch given below shows the velocity and distance of a few galaxies. The curve turns down on the right. This shows that



(1) The Universe is contracting.

(2)*The Universe is expanding faster now than in the past.

(3) The Universe is expanding slower now than in the past.

(4) The Universe is younger than we think.

17. Compared with stars in the disk, orbits of stars in the halo

(1) are elliptical but orbiting in the same direction.

(2) are relatively uniform to each other.

(3)*are elliptical, with random orientations.

(4) do not have to be around the galactic centre.

18. The Sun has orbited the galaxy, more than _____ times during its 5 billion years lifetime.

(1) 200 (2) 2

(3) 2000 (4)*20

19. What do we mean by a protogalactic cloud?

(1) The cloud-like halo that surrounds the disks of spiral galaxies.

(2) A term once used historically to refer to any galaxy.

(3)*A cloud of hydrogen and helium that contracts to become a galaxy.

(4) A cloud of gas that was once a galaxy.

20. Elements heavier than hydrogen and helium constitute about _____ of the mass of the Milky way's interstellar medium.

(1) 4% (2) 3%

(3)*2% (4) 1%

21. The incident power per unit area received at the surface of the Earth is known as

(1) luminosity (2)*apparent brightness

(3) black body radiation (4) both (1) and (2)

22. Some data for the variable star Betelgeuse are given below:

Average apparent brightness = 1.6×10^{-7} Wm^{-2}

Radius = 790 solar radii

Earth-Betelgeuse separation = 138 pc

The luminosity of the Sun is 3.8×10^{26} W and it has a surface temperature of 5800 K.

Calculate the distance between the Earth and Betelgeuse in metres.

(1)*4.3×10^{18} m (2) 5.3×10^{19} m

(3) 6.3×10^{18} m (4) 7.3×10^{19} m

23. The line spectrum of the light from the quasar 3C 273 contains a spectral line of wavelength 750 nm. The wavelength of the same line, measured in the laboratory, is 660 nm. Using a value of H_0 equal to 70 km s^{-1} Mpc^{-1}, estimate the distance of the quasar from Earth.

(1) 890 Mpc (2) 690 Mpc

(3)*590 Mpc (4) 473 Mpc

24. A distant quasar is detected to have a redshift of value = 5.6.

Calculate the speed at which the quasar is currently moving relative to the Earth.

(1) 8.6 c (2)*5.6 c

(3) 4.6 c (4) 2.6 c

25. Nuclear fusion processes inside stars can only synthesize elements with a nucleon number less than

(1) 73 (2) 83

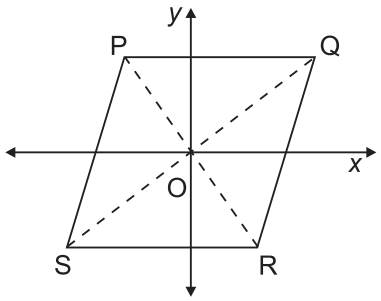
(3)*63 (4) 93

26. A star of known luminosity that, when compared with its apparent brightness, can be used to calculate its distance is known as

(1) Apparent brightness (2) Stellar parallax

(3)*Standard candle (4) Cosmological redshift

27. PQRS is a parallelogram. Coordinates of Q and R are Q(8, 2) and R(4, –2). What would be the coordinates of P, Q, R and S if the parallelogram is shifted so that SR is placed on the *x*-axis with S as the origin?



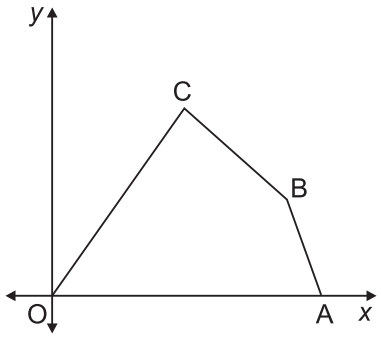
(1) (–4, 4), (–16, –4), (–12, 0) and (0, 0)

(2) (4, –4), (8, 2), (4, –2) and (0, 0)

(3)*(4, 4), (16, 4) (12, 0) and (0, 0)

(4) (–4, 2), (16, 4), (12, 0) and (–8, –2)

28. The vertices of quadrilateral OABC are O(0, 0), A(28, 0), B(24, 8) and C(8, 24). Find the midpoint of the line joining the midpoints of $\overline{OA}$ and $\overline{BC}$.



(1)*(15, 8) (2) (14, 0)

(3) (16, 16) (4) (20, 24)

29. Assuming a constant acceleration of a_x = 4.3 m/s^2 starting from rest, what is the airplane's takeoff velocity after 18.4 s? How far down the runway has the plane moved by the time it takes off?

(1) 760 m (2)*728 m

(3) 740 m (4) 750 m

30. Maxwell's equations relate to _____.

(1) law of gravitation

(2)*basic laws of electromagnetism

(3) laws of electrostatics

(4) nuclear model of an atom

31. To measure the distance of a planet from the earth _____ method is used.

(1) echo (2) direct

(3)*parallax (4) paradox

32. A_____ is the interval from one noon to the next noon.

(1) mean solar day (2)*solar day

(3) lunar day (4) day

33. The moon subtends an angle of 57 minute at the base-line equal to the radius of the earth. What is the distance of the moon from the earth? [Radius of the earth = 6.4×10^6 m]

(1) 11.22×10^8 m (2)*3.86×10^8 m

(3) 3.68×10^{-3} cm (4) 3.68×10^8 cm

34. The angular diameter of the sun is 1920". If the distance of the sun from the earth is 1.5×10^{11} m, then the linear diameter of the sun is

(1) 2.6×10^9 m (2) 0.7×10^9 m

(3) 5.2×10^9 m (4)*1.4×10^9 m

35. The value of acceleration due to gravity is 980 cm s^{-2}. If the unit of length is kilometre and that of time is minute then value of acceleration due to gravity is

(1) 980 km min^{-2}

(2) 98 km min^{-2}

(3)*35.28 km min^{-2}

(4) 28.35 km min^{-2}

36. If an artificial satellite is moving in a circular orbit around the earth with a speed equal to half the magnitude of the escape velocity from the earth, the height of the satellite above the surface of the earth is

(1) 2R (2) R/2

(3)*R (4) R/4

37. A satellite is orbiting very close to planet. Its time period depends only upon:

(1)*density of the planet

(2) mass of the planet

(3) radius of the planet

(4) mass of the satellite

38. If suddenly the gravitational force of attraction between earth and a satellite revolving around it becomes zero, then the satellite will

(1) continue to move in its orbit with same velocity

(2)*move tangentially to the original orbit with the same velocity

(3) become stationary in its orbit

(4) move towards the earth

39. The escape velocity on the surface of the earth is 11.2 km/s. If mass and radius of a planet are 4 and 2 times respectively than that of earth, the escape velocity from the planet will be

(1) 11.2 km/s (2) 1.112 km/s

(3)*15.8 km/s (4) 22.4 km/s

40. The ratio of the energy required to raise a satellite upto a height R (radius of earth) from the surface of earth to that required to put it into orbit there is

(1) 1:1 (2) 8:1

(3) 4:1 (4)*2:3

INTERACTIVE SECTION

41. If you could travel in a spaceship at the speed of light away from the solar system, how long could you see the sun?

(1) 3 years (2)*30 years

(3) 300 years (4) 3000 years

42. How far have spacecraft from Earth traveled into space?

(1) Well over 10 Light-years

(2) Well over 1 Light-year

(3)*Somewhat less than one Light-day

(4) A bit less than two Light-years

43. The experimental satellite SROSS abbreviation means

(1)*Stretched Rohini Satellite Series

(2) Super Rohini Satellite Series

(3) Subsystem Rohini Satellite Series

(4) Subcontracted Rohini Satellite Series

44. A particle hanging from a massless spring stretches it by 2 cm at earths surface. How much will the same particle stretch the spring at height 2624 km from the surface of earth? (Radius of earth = 6400 km)

(1)*1 cm (2) 2 cm

(3) 3 cm (4) 4 cm

45. The gravitational potential difference between the surface of a planet and a point 20 m above it is 16 J/kg. Then the work done in moving a 2 kg mass by 8 m on a slope 60 degree from the horizontal, is

(1)*11.1 J (2) 5.55 J

(3) 16 J (4) 27.7 J

46. A satellite is launched into a circular orbit of radius R around the earth. A second satellite is launched into an orbit of radius 1.01 R. The time period of the second satellite is larger than that of the first one by approximately

(1) 0.5% (2)*1.5%

(3) 1% (4) 3.0%

47. Two spherical bodies having the mass M and 5M and radii R and 2R respectively are released in free space with initial separation between their centres equal to 12 R. If they attract each other due to gravitational force only, then the distance covered by the smaller body just before collision is

(1) 2.5 R (2) 4.5 R

(3)*7.5 R (4) 1.5 R

48. The earth is an approximate sphere. If the interior contained matter which is not of the same density everywhere, then on the surface of the earth, the acceleration due to gravity

(1) will be directed towards the centre but not the same everywhere

(2) will have the same value everywhere but not directed towards the centre

(3) will be same everywhere in magnitude directed towards the centre

(4)*cannot be zero at any point

49. As observed from earth, the sun appears to move in an approximate circular orbit. For the motion of another planet like mercury as observed from earth, this would

(1) be similarly true

(2) not be true because the force between earth and mercury is not inverse square law

(3)*not be true because the major gravitational force on mercury is due to sun

(4) not be true because mercury is influenced by forces other than gravitational forces

50. Satellites orbiting the earth have finite life and sometimes debris of satellites fall to the earth. This is because

(1) the solar cells and batteries in satellites run out

(2) the laws of gravitation predict a trajectory spiralling inwards

(3)*of viscous forces causing the speed of satellite and hence height to gradually decrease

(4) of collisions with other satellites

51. Both earth and moon are subject to the gravitational force of the sun. As observed from the sun, the orbit of the moon

(1) will be elliptical

(2)*will not be strictly elliptical because the total gravitational force on it is not central

(3) is not elliptical but will necessarily be a closed curve

(4) deviates considerably from being elliptical due to influence of planets other than earth

52. If the law of gravitation, instead of being inverse-square law, becomes an inverse-cube law

(1)*planets will not have elliptic orbits

(2) circular orbits of planets is not possible

(3) there will be no gravitational force inside a spherical shell of uniform density

(4) both (a) and (b)

53. Which of the following are true?

(1) A polar satellite goes around the earth's pole in east-west direction.

(2) A geostationary satellite goes around the earth in east-west direction.

(3)*A geostationary satellite goes around the earth in west-east direction.

(4) A polar satellite goes around the earth in east-west direction.

54. Which of these is not a launch vehicle of the Indian Space Research Organisation (ISRO)?

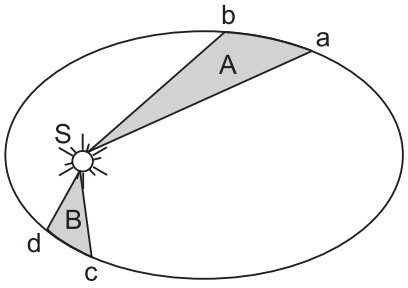
(1) ASLV

(2) GSLV

(3)*HSLV

(4) PSLV

55. The figure shows the motion of a planet around the sun in an elliptical orbit with sun at the focus. The shaded areas A and B are also shown in the figure which can be assumed to be equal. If t_1 and t_2 represent the time for the planet to move from *a* to *b* and *d* to *c* respectively, then



(1) $t_1 < t_2$

(2) $t_1 > t_2$

(3)* $t_1 = t_2$

(4) $t_1 \leq t_2$

56. Whereas latitude and longitude are the coordinates of places on earth, the coordinates used for star locations are

(1) ascension and altitude

(2)*right ascension and declination

(3) declination and altitude

(4) polar angle and ascension

57. The 2.7 kelvin cosmic background radiation is concentrated in the:

(1)*radio wavelengths

(2) infrared

(3) visible

(4) ultraviolet

58. Galileo discovered something about Venus with his telescope that shook the old theories. Which of the following was Galileo's discovery?

(1) Venus was covered in clouds.

(2)*Venus had phases like the moon.

(3) Venus' surface was similar to the earth's.

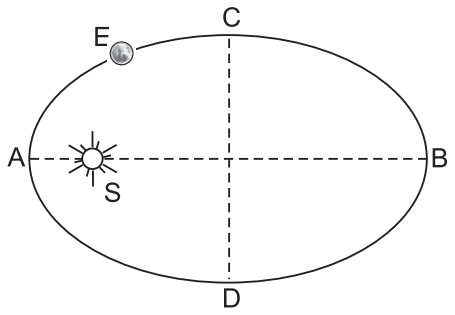
(4) Venus had retrograde motion.

59. In order to derive the law of gravitation, Newton assume that the moon's orbit is

(1)*Circular (2) Parabolic

(3) Uniform (4) Straight

60. The earth E moves in an elliptical orbit with the sun *S* at one of the foci as shown in figure. Its speed of motion will be maximum at the point



(1) C

(2)*A

(3) B

(4) D

* denotes answer.

END OF THE EXAM