KEAM 2022 Question Paper with Solution

Kerala Engineering Architecture Medical Entrance Exam

WARNING	Any malpractice or any attempt to commit any kind of malpractice in the Examination will DISQUALIFY THE CANDIDATE.

PAPER – I PHYSICS & CHEMISTRY - 2022

Version Code	A1	Question Booklet Serial Number :	8127746

Time: 150 Minutes	Number of Questions : 120	Maximum Marks : 480

Name of the Candidate	
Roll Number	
Signature of the Candidate	

INSTRUCTIONS TO CANDIDATES

1. **Please ensure that the VERSION CODE shown at the top of this Question Booklet is same as that shown in the OMR Answer Sheet issued to you.** If you have received a Question Booklet with a different Version code, please get it replaced with a Question Booklet with the same Version Code as that of OMR Answer Sheet from the Invigilator. **THIS IS VERY IMPORTANT.**
2. Please fill the items such as Name, Roll Number and Signature in the columns given above. Please also write Question Booklet Serial Number given at the top of this page against item 3 in the OMR Answer Sheet.
3. This Question Booklet contains 120 questions. For each question five answers are suggested and given against (A), (B), (C), (D) and (E) of which only one will be the '**Most Appropriate Answer**'. Mark the bubble containing the letter corresponding to the 'Most Appropriate Answer' in the OMR Answer Sheet, by using either **Blue or Black Ball Point Pen only.**
4. **Negative Marking**: In order to discourage wild guessing the score will be subjected to penalization formula based on the number of right answers actually marked and the number of wrong answer marked. Each correct answer will be awarded FOUR marks. ONE mark will be deducted for each incorrect answer. More than one answer marked against a question will be deemed as incorrect answer and will be negatively marked.
5. Please read the instructions in the OMR Answer Sheet for marking the answers. Candidates are advised to strictly follow the instruction contained in the OMR Answer Sheet.

IMMEDIATELY AFTER OPENING THE QUESTION BOOKLET, THE CANDIDATE SHOULD VERIFY WHETHER THE QUESTION BOOKLET CONTAINS ALL THE 120 QUESTIONS IN SERIAL ORDER. IF NOT, REQUEST FOR REPLACEMENT.

DO NOT OPEN THE SEAL UNTIL THE INVIGILATOR ASKS YOU TO DO SO.

SEAL

PLEASE ENSURE THAT THIS QUESTION BOOKLET CONTAINS 120 QUESTIONS SERIALLY NUMBERED FROM 1 TO 120 PRINTED PAGES 32.

1. The dimensional formula for the power of a lens is

(A) $[L^{-1}M^{\circ}T^{\circ}]$ (B) $[L^{\circ}M^{-1}T^{\circ}]$ (C) $[L^{\circ}M^{\circ}T^{-1}]$

(D) $[L^{\circ}M^{\circ}T^{\circ}]$ (E) $[L^{-1}M^{\circ}T^{-1}]$

2. The technology related with the Bernoulli's principle is used in

(A) hydroelectric power (B) rocket propulsion (C) aeroplane

(D) steam engine (E) electron microscope

3. The final result of the sum of the numbers 523.32, 1.21524 and 107.3 rounded to correct significant figures is

(A) 631.8 (B) 631.835 (C) 631.83 (D) 631.8352 (E) 631.83524

4. A cyclist starting from rest moves with uniform acceleration and covers 120 m in 10 s. Then his acceleration in ms^{-2} is

(A) 5 (B) 1.5 (C) 2.4 (D) 3 (E) 4.8

Space for rough work

5. The angle made by $\vec{r} = 3\vec{i} + 3\vec{j}$ with the x axis is

(A) 30° (B) 60° (C) 180° (D) 90° (E) 45°

6. In projectile motion, the physical quantity that remains invariant throughout is

(A) vertical component of velocity

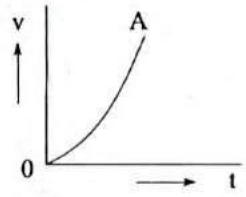
(B) horizontal component of velocity

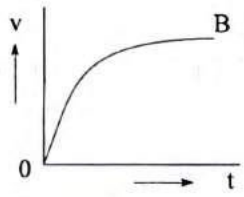
(C) kinetic energy of the projectile

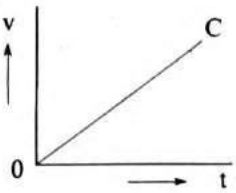
(D) potential energy of the projectile

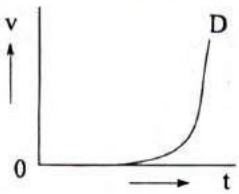
(E) linear momentum of the projectile

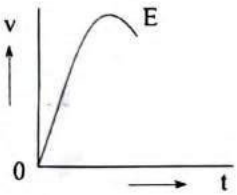
7. Given below are the velocity-time graphs of five particles, A, B, C, D and E. The correct graph from the following v-t plots in which the velocity of the particle is a function of t^2 is

(A) 

(B) 

(C) 

(D) 

(E) 

Space for rough work

8. Which one of the following is not a contact force?

(A) frictional force
(B) buoyant force
(C) air resistance
(D) viscous force
(E) gravitational force

9. Two bodies of masses m and 4 m have kinetic energies in the ratio 1: 2. Their momenta p_1 and p_2 are in the ratio

(A) $1:2\sqrt{2}$ (B) $1: 2\sqrt{3}$ (C) $2\sqrt{2} : 1$ (D) $3\sqrt{2} : 1$ (E) $1: 3\sqrt{2}$

10. Work-energy theorem is an integral form of

(A) Newton's first law
(B) Law of equipartition of energy
(C) Newton's second law
(D) Newton's law of gravitation
(E) Newton's third law

11. Which one of the following statement is correct?

(A) In inelastic collisions, both momentum and kinetic energy are conserved
(B) In inelastic collisions, momentum is conserved and kinetic energy is not conserved
(C) In elastic collisions, momentum is conserved and kinetic energy is not conserved
(D) In inelastic collisions, momentum is not conserved and kinetic energy is conserved
(E) In elastic collisions, momentum is not conserved and kinetic energy is conserved

Space for rough work

12. In a tug of war, two opposite teams pull the rope with an equal and opposite force of 20 kN at each end of the rope. If the equilibrium condition exists in the rope, the tension in it is

(A) 10 kN (B) 20 kN (C) 40 kN (D) 15 kN (E) zero

13. A toy car of mass 80 g is maintained to move in a horizontal circle of radius 0.8 m with a velocity v ms^{-1}. If the centripetal force acting on it is 10 N, then the value of v in ms^{-1} is

(A) 1 (B) 5 (C) 100 (D) 20 (E) 10

14. A man weighing 70 kg is riding on a cart of mass 30 kg which moves along a level floor at a speed of $3\,ms^{-1}$. If he runs on the cart so that his velocity relative to the cart is $4\,ms^{-1}$ in the direction opposite to the motion of the cart, the speed of centre of mass of the system is

(A) $0.3\,ms^{-1}$ (B) $0.5\,ms^{-1}$ (C) $0.2\,ms^{-1}$ (D) $0.1\,ms^{-1}$ (E) zero

15. Two persons stand at the edges of a rotating circular platform at diametrically opposite points. If they start moving towards each other at uniform velocity, then its

(A) angular velocity decreases

(B) moment of inertia increases

(C) moment of inertia remains constant

(D) angular velocity increases and moment of inertia decreases

(E) both angular velocity and moment of inertia remain constant

Space for rough work

16. A solid metal cylinder A and a hollow metal cylinder B have same mass but their radii are in the ratio 2 : 1. Then the ratio of their respective moments of inertia about their own axis is

(A) 1 : 1 (B) 2 : 1 (C) 4 : 1 (D) 1 : 4 (E) 1 : 2

17. The angular momentum of a particle with respect to the origin will not be zero, if

(A) the directional line of linear momentum passes through the origin

(B) the particle is at the origin

(C) the angle between the position vector and linear momentum is 180°

(D) the linear momentum vanishes

(E) the angle between the position vector and linear momentum is 90°

18. The minimum speed at which an object of 1 kg mass is thrown from the surface of the moon so that it does not fall back to the moon is

(A) 2.3 km/hr (B) 3.2 km/hr (C) 11.2 km/hr (D) 1.2 km/s (E) 2.3 km/s

19. Weight of a body of mass m in its free fall above the surface of the earth is

(A) mg (B) $\sqrt{mg}$ (C) infinity (D) $m\sqrt{g}$ (E) zero

20. Two satellites A and B are orbiting a planet in circular orbits with radii $2R$ and R respectively. If the speed of satellite A is $2v$, then the speed of satellite B is

(A) $6\sqrt{2}v$ (B) $2\sqrt{2}v$ (C) $5\sqrt{2}v$ (D) $6v$ (E) $4v$

Space for rough work

21. Gravitational potential energy associated with two point masses, each of 1 kg, separated by a distance of 1 cm in Joule is (G = gravitational constant)

(A) 2G (B) 100G (C) 1000G (D) G (E) 500G

22. The relative viscosity of blood remains constant between

(A) 0°C and 37°C
(B) 30°C and 59°C
(C) 10°C and 47°C
(D) 0°C and 57°C
(E) 20°C and 47°C

23. If the Young's modulus of the material of a wire is numerically equal to ten times the stress applied to a wire of length l, then the change in the length of the wire is

(A) 0.1 l (B) 0.5 l (C) 0.2 l (D) 0.75 l (E) 0.25 l

24. The working of hydraulic lift is based on the principle of

(A) Bernoulli
(B) Toricelli's law
(C) Pascal's law
(D) Magnus effect
(E) Stoke's law

25. An ideal Carnot engine working with source temperature T_1 and sink temperature T_2, has efficiency η. Then the value of the ratio $\frac{T_1}{T_2}$ is

(A) $\frac{1}{1-\eta}$ (B) $\frac{1-\eta}{1}$ (C) $\frac{1}{\eta}$ (D) η (E) $\frac{\eta}{1-\eta}$

Space for rough work

26. A process in which the amount of heat supplied to the system goes fully to change its internal energy and temperature is

(A) adiabatic process
(B) cyclic process
(C) isobaric process
(D) isothermal process
(E) isochoric process

27. The INCORRECT statement is

(A) A liquid is incompressible and has free surface of its own
(B) A gas is compressible and occupy all the space available to it
(C) Pressure in a fluid at rest is same at all points which are at the same height
(D) The surface of water in a capillary is concave
(E) Surface tension is a force per unit area

28. Three identical silver cups A, B and C contain three liquids of same densities at same temperature higher than the temperature of the surrounding. If the ratio of their specific heat capacities is 1 : 2 : 4, then

(A) A cools faster than B but slower than C
(B) B cools faster than C but slower than A
(C) A cools faster than B and C
(D) C cools faster than B and A
(E) B cools faster than A and C

Space for rough work

29. A poly atomic molecule has 3 translational, 3 rotational degrees of freedom and 2 vibrational modes. The ratio of specific heats $\frac{C_P}{C_V}$ is

(A) $\frac{7}{5}$ (B) $\frac{3}{5}$ (C) $\frac{5}{6}$ (D) $\frac{5}{3}$ (E) $\frac{6}{5}$

30. The r.m.s. speed of molecules of an ideal gas at 27°C is 200 ms^{-1}. When the temperature is increased to 327°C, the r.m.s. speed of the molecules is changed to

(A) 490.2 ms^{-1} (B) 315.2 ms^{-1} (C) 282.8 ms^{-1}

(D) 425.5 ms^{-1} (E) 515.7 ms^{-1}

31. No process is possible whose sole result is the transfer of heat from a colder object to a hotter object. This is Clausius statement for

(A) Zeroth law of thermodynamics (B) First law of thermodynamics

(C) Second law of thermodynamics (D) Carnot's theorem

(E) Principle of refrigeration

32. In a gas at STP, if n is the number density of the molecules and r is the radius of the molecule, then the mean free path of the molecule is inversely proportional to

(A) nr^2 (B) nr (C) n^2r (D) $\sqrt{n}\,r$ (E) $\sqrt{nr}$

33. A tuning fork produces 4 beats per second with both 26.0 cm and 25.2 cm of stretched sonometer wire. Frequency of the fork is

(A) 285 Hz (B) 384 Hz (C) 512 Hz (D) 256 Hz (E) 484 Hz

Space for rough work

34. The time period of a simple pendulum of length L is 3 s. If the length of the pendulum is increased 4 times, the increase in time period of the simple pendulum is

(A) 3 s (B) 4 s (C) 5 s (D) 6 s (E) 2 s

35. The INCORRECT statement is

(A) The separation between two successive nodes is λ

(B) Antinodes are formed at both ends of an open organ pipe

(C) In a one end closed organ pipe node is formed at the closed end

(D) Nodes are formed at both ends of stretched string

(E) The separation between the successive node and antinode is $\lambda/4$

36. The ratio of the magnitudes of maximum acceleration to the corresponding velocity of a body undergoing simple harmonic motion, $x = a \sin 2\pi f t$ is

(A) $2\pi fa$ (B) $4\pi^2 fa$ (C) $2\pi f$ (D) infinity (E) zero

37. The force experienced by a proton moving in an electric field of intensity 3E is (e is the charge of the electron)

(A) Ee (B) 2 Ee (C) 3 Ee (D) Ee / 2 (E) Ee / 3

38. Around a stationary charge of +5μC, another charge −5μC is taken once round a circle of radius 4 cm. The amount of work done in Joule is

(A) $\frac{2\pi}{5}$ (B) $\frac{3\pi}{8}$ (C) zero (D) $\frac{4\pi}{5}$ (E) $\frac{\pi}{4}$

39. The charge present in a doubly ionized helium atom is

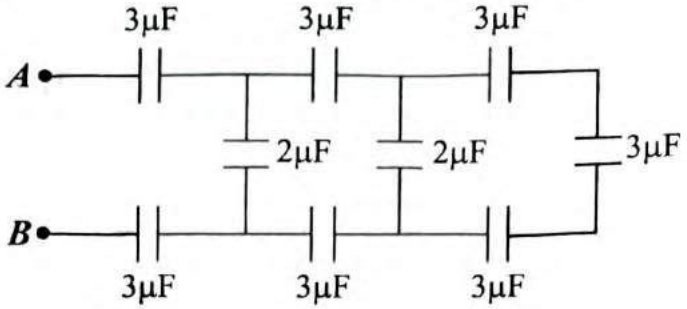
(A) 1.6×10^{-19} C (B) 6.4×10^{-19} C

(C) 4.8×10^{-19} C (D) 8.0×10^{-19} C

(E) 3.2×10^{-19} C

Space for rough work

40. The effective capacitance between A and B in the given figure is



(A) 1.5μF (B) 1μF (C) 3μF (D) 2μF (E) 2.5μF

41. The electrostatic force between a proton and an electron for certain distance of separation is F_1 and that between an electron and positron at the same distance of separation is F_2. Then the ratio $F_1 : F_2$ is

(A) 1 : 1 (B) 1 : 2 (C) 1879 : 1 (D) 1 : 1879 (E) 2 : 1

42. Conservation of charge and conservation of energy are respectively the basis of

(A) Joule's law and Ampere's circuital law

(B) Gauss' law and Ohm's law

(C) Kirchhoff's junction rule and loop rule

(D) Coulomb's inverse square law and Gauss' law

(E) Joule's law and Ohm's law

43. The INCORRECT statement is

(A) Resistivity of copper increases with increase of temperature

(B) Resistivity of germanium decreases with the increase of temperature

(C) Resistivity of semiconductors is higher than that of the conductors

(D) Resistivity of nichrome shows a weak dependence with temperature

(E) Resistivity of insulators is independent of temperature

Space for rough work

44. The three colours in a carbon resistor are red, black and orange. If the fourth colour is absent, then the value of tolerance of the resistor is

(A) ± 2000 Ω (B) ± 1000 Ω (C) ± 3000 Ω (D) ± 4000 Ω (E) ± 200 Ω

45. Material that is widely used to make wire bound standard resistors is

(A) manganin (B) iron (C) copper (D) tungsten (E) germanium

46. An electron and a proton moving with same velocity v enter into a uniform perpendicular magnetic field. Then

(A) proton alone moves in straight line path

(B) electron alone moves in straight line path

(C) both move in straight line paths

(D) both move in elliptical paths

(E) both move in circular paths

47. In a moving coil galvanometer, when the number of turns of the coil is doubled,

(A) both the current sensitivity and voltage sensitivity are doubled

(B) the current sensitivity is halved but voltage sensitivity remains unchanged

(C) the current sensitivity remains unchanged but voltage sensitivity is doubled

(D) the current sensitivity is doubled but voltage sensitivity remains unchanged

(E) both the current sensitivity and voltage sensitivity remain unchanged

48. The strength of earth's magnetic field at a point is 0.4×10^{-5} T. If this field is to be annulled by the magnetic induction produced at the centre of a circular conducting loop of radius π cm, the current to be sent through the loop is

(A) 2 A (B) 0.15 A (C) 1.5 A (D) 0.2 A (E) 1A

Space for rough work

49. Similar or same magnetic fields can be produced by

(A) a solenoid and a bar magnet
(B) a solenoid and a toroid
(C) a solenoid and a circular coil
(D) a circular coil and a toroid
(E) a bar magnet and a toroid

50. The INCORRECT statement is

(A) The direction of eddy currents is given by Lenz' law.
(B) A choke coil is a pure inductor used for controlling current in an A.C. circuit.
(C) The r.m.s. value of A.C. current is $\sqrt{2}$ times the peak value of A.C. current.
(D) Quality factor is a measure of sharpness of resonance in A.C. circuit.
(E) Magnetic field energy stored in an inductor of inductance L is $\frac{1}{2}LI^2$.

51. The ratio of energy stored per unit volume in a solenoid having magnetic induction B to the electrostatic energy stored per unit volume in a capacitor in electric field E is

(A) $\frac{B^2c}{E^2}$ (B) $\frac{B^2c^2}{E^2}$ (C) $\frac{Bc^2}{E^2}$ (D) $\frac{B^2c^2}{E}$ (E) $\frac{B^2c^2}{2E^2}$

52. Find the mismatch pair

(A) Induction furnace : eddy current
(B) A.C. generator : armature coil
(C) LCR circuit : resonance
(D) Transformer : D.C. voltage
(E) Magnetic brakes : magnetic flux

Space for rough work

53. When an A.C. voltage of $V = 330 \sin(100\pi t)$ is applied to a capacitor, it produces a current of $I = 1.5 \cos(100\pi t)$. The capacitive reactance of the capacitor is

(A) 120 Ω (B) 180 Ω (C) 200 Ω (D) 220 Ω (E) 280 Ω

54. Radio waves are

(A) produced by hot bodies

(B) in the frequency range 10^9 Hz to 10^{12} Hz

(C) suitable for radar systems

(D) used in cellular phones to transmit voice communication

(E) used to kill germs in water purifiers

55. The electromagnetic waves that cause greenhouse effect are

(A) X-rays (B) Cathode rays (C) UV rays

(D) Gamma rays (E) Infrared rays

56. The power of a corrective lens is -4.0 D. The lens is

(A) convex lens of focal length + 25 cm

(B) concave lens of focal length – 25 cm

(C) convex lens of focal length + 4 cm

(D) concave lens of focal length – 4 cm

(E) convex lens of focal length + 20 cm

Space for rough work

57. The INCORRECT statement is

(A) Optical density is the ratio of speed of light in two media.

(B) Hotter air is less dense than the cooler air.

(C) Cooler air has higher refractive index than the hotter air.

(D) The refractive index of air decreases with its density.

(E) Optical density of air increases with height of air layer.

58. A plane wave front is incident on a thin prism, thin convex lens and a concave mirror separately. The wave front(s) emerging out from the

(A) concave mirror is plane

(B) thin prism is spherical

(C) convex lens and concave mirror are plane

(D) convex lens and prism are plane

(E) convex lens and concave mirror are spherical

59. If the Young's double slit experimental set up is immersed in a liquid of refractive index μ, the fringe width of the interference pattern observed is β. When the experiment is performed in air medium with the same experimental set up, the fringe width of the pattern will be

(A) β (B) $\frac{\beta}{\mu}$ (C) $(\mu+1)\beta$ (D) $\mu\beta$ (E) $(\mu-1)\beta$

60. Two rays of light A and B are falling on a glass slab at the angles of incidence 45° and 60°. If the reflected ray of A is partially polarized and that of B is completely polarized, then the refractive index of glass is

(A) 1.33 (B) 1.414 (C) 1.5 (D) 1.65 (E) 1.732

Space for rough work

61. The momenta of a proton, a neutron and an electron are in the ratio 3:2:1, then their respective de Broglie wavelengths are in the ratio

(A) 1 : 1 : 1 (B) 2 : 3 : 6 (C) 1 : 2 : 3 (D) 6 : 3 : 2 (E) 4 : 2 : 1

62. The material that is not photo sensitive to visible light is

(A) caesium (B) sodium (C) rubidium

(D) cadmium (E) potassium

63. The energy equivalent of 5 g of a substance is

(A) 4.5×10^{12} J (B) 9×10^{12} J (C) 4.5×10^{14} J

(D) 4.5×10^{16} J (E) 9×10^{16} J

64. The INCORRECT statement is

(A) Nuclear density is independent of the mass number A of the nucleus.

(B) Average binding energy per nucleon is very high for light nuclei.

(C) Nuclear forces are strongest in nature.

(D) In a radioactive nucleus, the half life period is directly proportional to mean life.

(E) Becquerel (Bq) is the SI unit of activity of a radioactive source.

65. In Bohr atom model, the total energy of the electron in hydrogen atom is -3.4eV. Then its angular momentum about the nucleus of the atom is (h = Planck's constant)

(A) $\frac{h}{\pi}$ (B) $\frac{h}{2\pi}$ (C) $\frac{2h}{\pi}$ (D) $\frac{4h}{\pi}$ (E) $\frac{h}{4\pi}$

Space for rough work

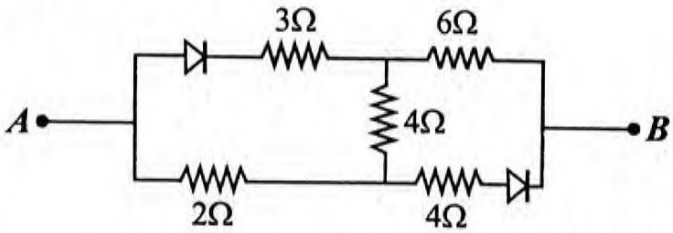
66. In a nuclear reactor, the ratio of number of fission produced by a given generation of neutrons to the number of fission of the preceding generation is known as

(A) quality factor
(B) nuclear reaction factor
(C) multiplication factor
(D) fission ratio
(E) response ratio

67. The special purpose diode operated / working under forward bias is / are

(A) zener diode and LED
(B) photo diode and LED
(C) zener diode and solar cell
(D) LED
(E) photo diode

68. If the potential at A is greater than the potential at B, then the equivalent resistance of the circuit across AB is



(A) 4.4 Ω
(B) 5.2 Ω
(C) 6 Ω
(D) 9 Ω
(E) 3.6 Ω

Space for rough work

69. When light falls on a solar cell, the generation of emf happens due to

(A) generation of electron-hole pairs only

(B) generation and collection of electron-hole pairs only

(C) collection of electron-hole pairs only

(D) generation, separation and collection of electron-hole pairs

(E) separation and collection of electron-hole pairs only

70. Logic gates are given the inputs A = 0 and B = 1 in case (a) and A = 1 and B = 0 in case (b). The gates giving output of y = 1 for both the cases are

(A) OR and AND

(B) OR and NAND

(C) AND and NOR

(D) NOR and NAND

(E) AND and NAND

71. The minimum length of the dipole antenna for a carrier wave frequency of 200 MHz is nearly

(A) 1.75 m (B) 0.52 m (C) 0.25 m (D) 0.38 m (E) 0.75 m

72. In communication systems, the device used to convert energy from one form to another form is

(A) repeater

(B) transducer

(C) amplifier

(D) attenuator

(E) antenna

Space for rough work

73. Which one of the following contains the highest number of oxygen atoms?

(A) One mole of aluminum sulphate

(B) Two moles of ferrous sulphate

(C) Three moles of hydrogen peroxide

(D) Two moles of potassium permanganate

(E) One mole of potassium dichromate

74. Among the following pairs of compounds, the one that does not illustrate the law of multiple proportions, is

(A) NO and NO_2

(B) CuO and Cu_2O

(C) FeO and Fe_2O_3

(D) H_2O and H_2S

(E) NO and N_2O

75. A dinegative ion of the element X consists of 10 electrons and 8 neutrons. A dipositive ion of the element Y consists of 12 protons. The number of neutrons in Y is 1.5 times the number of electrons in atom X. Then the mass numbers of X and Y would be in the ratio

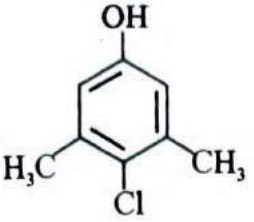
(A) 1:2 (B) 2:3 (C) 3:2 (D) 2:5 (E) 1:3

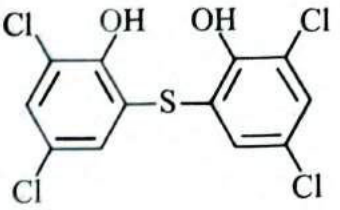
76. A particle of mass 6.6×10^{-31} kg is moving with a velocity of $1\times10^{7}\,ms^{-1}$. The de Broglie wavelength (in $\mathring{A}$) associated with the particle, is $\left(h=6.6\times10^{-34}\,Js\right)$

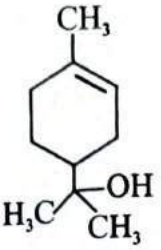
(A) 1 (B) 10 (C) 5 (D) 2 (E) 4

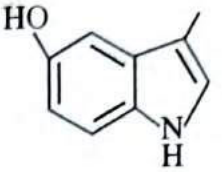
Space for rough work

77. From the following, choose the correct structures of chloroxylenol and terpineol, which are the constituents of "Dettol"

(a) 

(b) 

(c) 

(d) 

(A) a and b (B) b and c (C) a and d (D) a and c (E) b and d

78. A fast moving particle of mass 6.63×10^{-28} g can be located with an accuracy of 1Å. The uncertainty in its velocity $\left(\text{in } ms^{-1}\right)$ is about $\left(h=6.63\times10^{-34}\ Js\right)$

(A) 8×10^{3} (B) 8×10^{4} (C) 8×10^{5} (D) 8×10^{6} (E) 8×10^{7}

79. Which one of the following molecules contains an incomplete octet of the central atom?

(A) SF_6 (B) $AlCl_3$ (C) CH_4 (D) PF_5 (E) H_2O

Space for rough work

80. Which one of the following reactions involves change from sp^2 to sp^3 hybridisation of the central atom?

(A) $CH_4 + 2Cl_2 \longrightarrow CH_2Cl_2 + 2HCl$

(B) $NH_3 + H^+ \longrightarrow NH_4^+$

(C) $AlCl_3 + Cl^- \longrightarrow AlCl_4^-$

(D) $H_2O + H^+ \longrightarrow H_3O^+$

(E) $PCl_3 + Cl_2 \longrightarrow PCl_5$

81. The dipole-dipole interaction energy between rotating polar molecules is proportional to _____, where 'r' is the distance between polar molecules.

(A) $\frac{1}{r^4}$ (B) $\frac{1}{r^9}$ (C) $\frac{1}{r^3}$ (D) $\frac{1}{r^2}$ (E) $\frac{1}{r^6}$

82. A metal 'X' crystallises in a body centred cubic structure and its metallic radius is 346.4 pm. The length (in pm) of the unit cell is

(A) 200 (B) 800 (C) 600 (D) 500 (E) 400

83. The standard enthalpy of formation of $CH_4(g)$, $CO_2(g)$ and $H_2O(l)$ are –75 kJ mol^{-1}, –393 kJ mol^{-1} and –286 kJ mol^{-1} respectively. The amount of heat liberated (in kJ) when 3.2g of methane gas is burnt under standard conditions is

(A) 89 (B) 278 (C) 890 (D) 965 (E) 178

84. Which one of the following is the correct relation between C_P and C_V for one mole of an ideal gas? (R is molar gas constant)

(A) $C_P = C_V - R$ (B) $C_P = C_V + R$ (C) $C_P = R - C_V$

(D) $C_P = C_V \times R$ (E) $C_P = C_V / R$

Space for rough work

85. Some of the reactions and their equilibrium constants K_c are given. Choose the reaction which proceeds rarely at the given temperature.

(A) $2H_2(g) + O_2(g) \rightleftharpoons 2H_2O(g)$; $K_c = 2.4 \times 10^{47}$ at 500K

(B) $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$; $K_c = 57.0$ at 700K

(C) $H_2(g) + Cl_2(g) \rightleftharpoons 2HCl(g)$; $K_c = 4.0 \times 10^{31}$ at 300K

(D) $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$; $K_c = 4.8 \times 10^{-31}$ at 298K

(E) $H_2(g) + Br_2(g) \rightleftharpoons 2HBr(g)$; $K_c = 5.4 \times 10^{18}$ at 300K

86. The equilibrium constants for the following two reactions at 298K are given below:

$2A \rightleftharpoons B + C$; $K_1 = 16$

$2B + C \rightleftharpoons 2X$; $K_2 = 25$

What is the value of K for the reaction, $A + \frac{1}{2}B \rightleftharpoons X$ at 298K?

(A) $\frac{1}{5}$ (B) $\frac{1}{40}$ (C) $\frac{5}{4}$ (D) $\frac{4}{5}$ (E) 20

87. The average oxidation number of bromine in Br_3O_8 is

(A) $\frac{16}{3}$ (B) $\frac{4}{3}$ (C) $\frac{3}{4}$ (D) $\frac{5}{2}$ (E) $\frac{8}{3}$

88. The standard electrode potentials of some electrodes are given below:

Fe^{3+}/Fe^{2+} 0.77V; Br_2/Br^- 1.09V; I_2/I^- 0.54V; $Zn^{2+}/Zn(s)$ –0.76V;
$Ag^+/Ag(s)$ 0.80V; $Fe^{2+}/Fe(s)$ –0.44V; $Cu^{2+}/Cu(s)$ 0.34V

Predict the reaction that is not feasible:

(A) $Fe^{3+}(aq)$ oxidises $I^-(aq)$ (B) $Ag^+(aq)$ oxidises Cu(s)

(C) Ag(s) reduces $Fe^{3+}(aq)$ (D) $Br_2(aq)$ oxidises $Fe^{2+}(aq)$

(E) Zn(s) reduces $Cu^{2+}(aq)$

Space for rough work

89. The chemistry teacher asked the students to prepare 20% w/w solution of urea [NH_2CONH_2] in water. Which one of the following solution does not conform to the required composition?

(A) 6g urea dissolved in 24g water

(B) 20g urea dissolved in 80g water

(C) 10g urea dissolved in 40g water

(D) 4g urea dissolved in 16g water

(E) 15g urea dissolved in 30g water

90. The vapour pressures of pure liquids X and Y at 350K are 200 mm and 300 mm of Hg respectively. Then the correct vapour pressure (in mm of Hg) of an ideal solution containing X and Y in the mole ratio 3 : 2 at the same temperature is

(A) 120 (B) 180 (C) 260 (D) 240 (E) 160

91. In a reaction $3A \rightarrow$ Products, the concentration of A decreases from 0.4 mol L^{-1} to 0.1 mol L^{-1} in 20 minutes at 300K. The rate of decrease in [A] during this interval (in mol L^{-1} min^{-1}) at 300K is

(A) 0.005 (B) 0.015 (C) 0.001 (D) 0.15 (E) 0.05

92. The half-life period of a first order reaction at 298K is 20 minutes. The time (in min.) required for 99.9% completion of the reaction at the same temperature, is

(A) 100 (B) 200 (C) 150 (D) 250 (E) 300

Space for rough work

93. The critical temperature of some gases are: Methane 190K, ammonia 405K, carbon dioxide 304K, n-butane 425K and dihydrogen 33K. The gas that is adsorbed to the maximum extent on 1g of activated charcoal at a given temperature is

(A) dihydrogen (B) methane (C) carbon dioxide

(D) n-butane (E) ammonia

94. Which one of the following is not true with regard to physisorption?

(A) It arises because of van der Waals' forces

(B) It is not specific in nature

(C) High activation energy is needed

(D) It depends on the nature of gas

(E) Enthalpy of adsorption is low (20 - 40 kJ mol^{-1})

95. Match the following:

a) Saline hydride	(i) CrH
b) Electron-deficient hydride	(ii) CH_4
c) Electron-precise hydride	(iii) BeH_2
d) Electron-rich hydride	(iv) B_2H_6
e) Metallic hydride	(v) H_2O

Choose the correct option :

(A) a)-(iii); b)-(ii); c)-(iv); d)-(v); e)-(i)

(B) a)-(iii); b)-(v); c)-(iv); d)-(ii); e)-(i)

(C) a)-(iv); b)-(ii); c)-(iii); d)-(v); e)-(i)

(D) a)-(iii); b)-(iv); c)-(ii); d)-(v); e)-(i)

(E) a)-(iii); b)-(i); c)-(ii); d)-(iv); e)-(v)

Space for rough work

96. The metal which dissolves in liquid ammonia to give a blue-black solution due to formation of solvated electron is

(A) aluminum (B) gallium (C) calcium

(D) silicon (E) germanium

97. Which one of the following processes does not produce dinitrogen?

(A) Thermal decomposition of ammonium dichromate

(B) Thermal decomposition of barium azide

(C) Treating an aqueous solution of ammonium chloride with sodium nitrite

(D) Thermal decomposition of sodium azide

(E) Thermal decomposition of ammonium nitrate

98. Which of the following compounds is used as refrigerant?

(A) CCl_2F_2 (B) $ClCH_2CH_2SCH_2CH_2Cl$ (C) CCl_4

(D) CCl_3NO_2 (E) $COCl_2$

99. Which of the following set of transition metals have high volatility?

(A) Ti, Zn and Hf (B) Cr, Mo and W

(C) Mn, Tc and Re (D) Fe, Ru and Os

(E) Zn, Cd and Hg

Space for rough work

100. Both Cr^{2+} and Mn^{3+} have d^4 configuration. Which one of the following is true?

(A) Mn^{3+} is a reducing agent but Cr^{2+} is an oxidising agent

(B) Mn^{3+} is an oxidising agent but Cr^{2+} is a reducing agent

(C) Both Mn^{3+} and Cr^{2+} are oxidising agents

(D) Both Mn^{3+} and Cr^{2+} are reducing agents

(E) Both Mn^{3+} and Cr^{2+} are neither reducing nor oxidising agents

101. The complexes $[Co(NH_3)_5NO_2]Cl_2$ and $[Co(NH_3)_5ONO]Cl_2$ are

(A) coordination isomers (B) geometrical isomers

(C) solvate isomers (D) ionization isomers

(E) linkage isomers

102. Which one of the following is not an ore of iron?

(A) Magnesite (B) Haematite (C) Magnetite

(D) Siderite (E) Iron pyrites

103. The overall complex dissociation equilibrium constant for $[Cr(H_2O)_6]^{3+}$ ion is 5×10^{-12}. The overall stability constant of the complex is

(A) 2×10^{-11} (B) 5×10^{11} (C) 5×10^{10}

(D) 2×10^{11} (E) 0.2×10^{11}

Space for rough work

104. Match the following:

a) Alkane	(i) Phenol
b) Alicyclic compound	(ii) Tropolone
c) Benzenoid aromatic compound	(iii) Isobutane
d) Non-benzenoid aromatic compound	(iv) Furan
e) Heterocyclic compound	(v) Cyclohexene

Choose the correct option:

(A) a)-(iii); b)-(i); c)-(v); d)-(ii); e)-(iv)

(B) a)-(iii); b)-(v); c)-(i); d)-(ii); e)-(iv)

(C) a)-(i); b)-(ii); c)-(iii); d)-(iv); e)-(v)

(D) a)-(iii); b)-(v); c)-(i); d)-(iv); e)-(ii)

(E) a)-(iii); b)-(ii); c)-(i); d)-(v); e)-(iv)

105. The elemental analysis of an organic compound gave C: 38.71%, H: 9.67%. What is the empirical formula of the compound?

(A) CH_2O (B) CH_3O (C) CH_4O (D) CHO (E) CH_5O

106. Which one of the following molecules contains only primary and tertiary carbon atoms?

(A) 2, 2-Dimethylbutane (B) 3-Methylpentane

(C) 2, 3-Dimethylbutane (D) n-Hexane

(E) 2-Methylhexane

Space for rough work

107. Calculate the number of σ and π bonds in 2-n-propylpent-1-ene.

(A) 22 σ bonds, 2π bonds
(B) 23 σ bonds, 1π bond
(C) 21 σ bonds, 1π bond
(D) 23 σ bonds, 2π bonds
(E) 20 σ bonds, 1π bond

108. Which one of the following molecules gives four isomeric monochlorides on photochemical chlorination?

(A) 2-Methylpropane
(B) n-Butane
(C) 2-Methylbutane
(D) 2, 3-Dimethylbutane
(E) Propane

109. Which of the following aryl chlorides on warming with water forms the corresponding phenol?

(A) 4-Methylchlorobenzene
(B) 4-Nitrochlorobenzene
(C) 2, 4, 6-Trinitrochlorobenzene
(D) 2-Nitrochlorobenzene
(E) 2, 4-Dinitrochlorobenzene

110. Resorcinol is

(A) Benzene-1, 3-diol
(B) Benzene-1, 4-diol
(C) Benzene-1, 2-diol
(D) 3-Methylphenol
(E) 4-Methylphenol

Space for rough work

111. Choose the correct order of acidity of the following phenols:

(I) *m*-nitrophenol (II) *p*-cresol (III) *p*-nitrophenol (IV) phenol

(A) (III) > (I) > (IV) > (II)

(B) (II) > (IV) > (III) > (I)

(C) (I) > (II) > (III) > (IV)

(D) (IV) > (II) > (III) > (I)

(E) (III) > (II) > (I) > (IV)

112. Which one of the following represents valeraldehyde?

(A) $CH_3CH_2CH_2CH_2CHO$

(B) $CH_3CH(CH_3)CH_2CHO$

(C) $CH_3CH(OCH_3)CHO$

(D) $(CH_3)_2CHCHO$

(E) $CH_3CH_2CH(CH_3)CHO$

113. Toluene on treatment with chromic oxide in acetic anhydride at 273K to 283K gives

(A) benzaldyde

(B) benzylidene diacetate

(C) benzoic acid

(D) benzyl alcohol

(E) phenylacetate

114. Among methanamine, ethanamine, benzenamine, N-methylaniline and N, N-dimethylaniline, the weakest and the strongest base in aqueous phase, respectively are

(A) benzenamine and methanamine

(B) N-methylaniline and ethanamine

(C) N, N-dimethylaniline and ethanamine

(D) benzenamine and ethanamine

(E) N-methylaniline and methanamine

Space for rough work

115. The product formed, when benzene diazonium fluoroborate is heated with aqueous sodium nitrite solution in the presence of copper is

(A) fluorobenzene (B) benzene (C) phenol

(D) *p*-nitrophenol (E) nitrobenzene

116. Which one of the following is a polysaccharide?

(A) Glycogen (B) Lactose (C) Maltose (D) Sucrose (E) Glucose

117. Which of the following is added to commercial salt to control hypothyroidism?

(A) Magnesium iodide (B) Potassium iodide (C) Sodium iodide

(D) Calcium iodide (E) Lithium iodide

118. Conveyor belt is manufactured from

(A) buna-S (B) neoprene (C) PVC

(D) teflon (E) glyptal

119. Which one of the following is a non-narcotic analgesics?

(A) Morphine (B) Codeine (C) Paracetamol (D) Heroin (E) Bithional

120. The primary precursor of photochemical smog that can be metabolised by plants such as Juniparus and Pyrus, is

(A) nitrogen dioxide (B) ozone (C) PAN

(D) carbon dioxide (E) sulphur dioxide

Space for rough work

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KEAM 2022 - ANSWER KEY

SUBJECT: PAPER I PHYSICS & CHEMISTRY

VERSION CODE: A1

1	A	21	B	41	A	61	B	81	E	101	E
2	C	22	A	42	C	62	D	82	B	102	A
3	A	23	A	43	E	63	C	83	E	103	D
4	C	24	C	44	D	64	B	84	B	104	B
5	E	25	A	45	A	65	A	85	D	105	B
6	B	26	E	46	E	66	C	86	E	106	C
7	A	27	E	47	D	67	D	87	A	107	B
8	E	28	D	48	D	68	E	88	C	108	C
9	A	29	E	49	A	69	D	89	E	109	C
10	C	30	C	50	C	70	B	90	D	110	A
11	B	31	C	51	B	71	D	91	A	111	A
12	C	32	A	52	D	72	B	92	B	112	A
13	E	33	D	53	D	73	A	93	D	113	B
14	C	34	D	54	D	74	D	94	C	114	D
15	D	35	A	55	E	75	B	95	D	115	E
16	B	36	D	56	B	76	A	96	C	116	A
17	E	37	C	57	D	77	D	97	E	117	C
18	E	38	C	58	E	78	C	98	A	118	B
19	E	39	E	59	B	79	B	99	E	119	C
20	B	40	B	60	E	80	C	100	B	120	A

WARNING	Any malpractice or any attempt to commit any kind of malpractice in the Examination will DISQUALIFY THE CANDIDATE.

PAPER – II MATHEMATICS - 2022

Version Code	B1	Question Booklet Serial Number: 9120933

Time: 150 Minutes	Number of Questions : 120	Maximum Marks : 480

Name of the Candidate	
Roll Number	
Signature of the Candidate	

INSTRUCTIONS TO CANDIDATES

1. **Please ensure that the VERSION CODE shown at the top of this Question Booklet is same as that shown in the OMR Answer Sheet issued to you.** If you have received a Question Booklet with a different Version code, please get it replaced with a Question Booklet with the same Version Code as that of OMR Answer Sheet from the Invigilator. **THIS IS VERY IMPORTANT.**
2. Please fill the items such as Name, Roll Number and Signature in the columns given above. Please also write Question Booklet Serial Number given at the top of this page against item 3 in the OMR Answer Sheet.
3. This Question Booklet contains 120 questions. For each question five answers are suggested and given against (A), (B), (C), (D) and (E) of which only one will be the '**Most Appropriate Answer**'. Mark the bubble containing the letter corresponding to the 'Most Appropriate Answer' in the OMR Answer Sheet, by using either **Blue or Black Ball Point Pen only.**
4. **Negative Marking**: In order to discourage wild guessing the score will be subjected to penalization formula based on the number of right answers actually marked and the number of wrong answer marked. Each correct answer will be awarded FOUR marks. ONE mark will be deducted for each incorrect answer. More than one answer marked against a question will be deemed as incorrect answer and will be negatively marked.
5. Please read the instructions in the OMR Answer Sheet for marking the answers. Candidates are advised to strictly follow the instruction contained in the OMR Answer Sheet.

IMMEDIATELY AFTER OPENING THE QUESTION BOOKLET, THE CANDIDATE SHOULD VERIFY WHETHER THE QUESTION BOOKLET CONTAINS ALL THE 120 QUESTIONS IN SERIAL ORDER. IF NOT, REQUEST FOR REPLACEMENT.

DO NOT OPEN THE SEAL UNTIL THE INVIGILATOR ASKS YOU TO DO SO.

PLEASE ENSURE THAT THIS QUESTION BOOKLET CONTAINS 120 QUESTIONS SERIALLY NUMBERED FROM 1 TO 120 PRINTED PAGES 32.

1. Let $A=\{1,2,3,4,5\}$ and let $B=\{1,2,3,4\}$. If the relation $R: A \to B$ is given by $(a, b) \in R$ if and only if $a+b$ is even, then $n(R)$ is equal to

(A) 10 (B) 16 (C) 20 (D) 12 (E) 6

2. The domain of the function $f(x)=\left(x^2-2x-63\right)^{3/2}$, $x \in \mathbb{R}$ is

(A) $(-\infty, -6] \cup [9, \infty)$
(B) $(-\infty, -9] \cup (7, \infty)$
(C) $(-\infty, -7] \cup [7, \infty)$
(D) $(-\infty, -5] \cup [9, \infty)$
(E) $(-\infty, -7] \cup [9, \infty)$

3. Let $A=\{x \in \mathbb{Z}: -1 \le x < 4\}$ and let $B=\{x \in \mathbb{Z}: 0 < \frac{x}{2} \le 3\}$. Then $A \cap B$ is equal to

(A) {1, 2, 3}
(B) {2, 3}
(C) {1, 2, 3, 4}
(D) {2, 3, 4}
(E) {0, 1, 2, 3}

4. Let $f(x)=\begin{cases} x+2, & \text{for } x<1 \\ 4x-1, & \text{for } 1 \le x \le 3 \\ x^2+5, & \text{for } x>3 \end{cases}$. Then

(A) $f(x)$ is not continuous at $x=-1$
(B) $f(x)$ is continuous at $x=1$
(C) $f(x)$ is continuous at $x=3$
(D) $f(x)$ is not continuous at $x=5$
(E) $f(x)$ is not continuous at $x=2$

Space for rough work

5. Let $\odot$ be a binary operation on $\mathbb{Q}-\{0\}$ defined by $a \odot b = \frac{a}{b}$.

Then $1 \odot (2 \odot (3 \odot 4))$ is equal to

(A) $\frac{3}{2}$ (B) $\frac{8}{3}$ (C) $\frac{4}{3}$ (D) $\frac{3}{4}$ (E) $\frac{3}{8}$

6. Let $f : \mathbb{R} \to \mathbb{R}$ be defined by $f(x) = \cos x$. Then

(A) f is one - one and odd
(B) f is odd but not one - one
(C) f is even and onto
(D) f is one - one and even
(E) f is even but not onto

7. If $n(A \cup B) = 97$, $n(A \cap B) = 23$ and $n(A - B) = 39$, then $n(B)$ is equal to

(A) 52 (B) 55 (C) 58 (D) 62 (E) 65

8. The principal argument of the complex number $z = \frac{8+4i}{1+3i}$ is equal to

(A) $\frac{\pi}{4}$ (B) $\frac{-\pi}{4}$ (C) $\frac{3\pi}{4}$ (D) $\frac{-3\pi}{4}$ (E) $\frac{\pi}{6}$

9. The minimum value of $|z+1|+|z-2|$ is equal to

(A) 1 (B) 2 (C) 3 (D) 4 (E) 0

Space for rough work

10. If $z = \dfrac{(3+i)(7-i)^2}{3-i}$, then the value of $|z|$ is equal to

(A) 48 (B) $\sqrt{50}$ (C) 50 (D) $\sqrt{500}$ (E) $\sqrt{48}$

11. The value of $\left[\dfrac{5i}{(1-i)(2-i)(3-i)}\right]^{50}$ is equal to

(A) $\left(\frac{1}{2}\right)^{25}$ (B) $\left(\frac{1}{2}\right)^{50}$ (C) $-\left(\frac{1}{2}\right)^{25}$ (D) $-\left(\frac{1}{2}\right)^{50}$ (E) $\left(\frac{1}{10}\right)^{50}$

12. If $z^4 = 7-5i$, then $\mathrm{Im}\left((\bar{z})^4\right)$ is equal to

(A) 5 (B) 7 (C) –7 (D) –5 (E) 0

13. The modulus of $\left(\dfrac{1+i}{1-i}\right)^{75} - \left(\dfrac{1-i}{1+i}\right)^{75}$ is

(A) 1 (B) 2 (C) $\frac{1}{2}$ (D) 4 (E) 16

Space for rough work

$\dfrac{(3+i)(7-i)^2}{3-i}$

$\dfrac{(3+i)(7^2-14i+i^2)}{3-i}$

$\dfrac{(3+i)(48-14i)}{3-i}$

$\dfrac{144+14+48i-42i}{3-i}$

$z = \dfrac{158+6i}{3-i}$

$|z|$ =

$\dfrac{5i}{(1-i)(2-i)(3-i)}$

$= \dfrac{5i}{(2-i-2i+i^2)(3-i)}$

$= \dfrac{5i}{(1-3i)(3-i)}$

$= \dfrac{5i}{3-9i-i-3}$

$= \dfrac{5i}{}$

$z^4 = 7-5i$

14. If z_1 and z_2 are two different complex numbers with $|z_2| = 1$, then $\left|\frac{1-\bar{z}_1 z_2}{z_1 - z_2}\right|$ is equal to

(A) 0 (B) $\frac{1}{2}$ (C) $\frac{1}{3}$ (D) $\frac{1}{4}$ (E) 1

15. If $-1+7i$, $-1+xi$ and $3+3i$ are the three vertices of an isosceles triangle which is right angled at $-1+xi$, then the value of x is equal to

(A) –1 (B) 3 (C) –3 (D) 7 (E) –7

16. The sum of the first 24 terms of the series $9+13+17+\cdots$ is equal to

(A) 1212 (B) 1200 (C) 1440 (D) 1320 (E) 1230

17. In an A.P. there are 18 terms and the last three terms of the A.P. are 67, 72, 77. Then the first term of the A.P. is

(A) –7 (B) 9 (C) –9 (D) –8 (E) 7

18. If the first term of a G.P. is 3 and the sum of second and third terms is 60, then the common ratio of the G.P. is

(A) 4 or – 3 (B) 4 only (C) 4 or 5 (D) 4 or – 5 (E) –5 only

19. If n^{th} term of a series is $n+(-1)^{n-1}$, $n = 1, 2, 3, \ldots$, then the sum of first 40 terms of the series is

(A) 810 (B) 820 (C) 821 (D) 819 (E) 780

Space for rough work

20. The 11^{th} term of the geometric series $\sum_{r=0}^{20} 2\times(-2)^r$ is equal to

(A) – 4096 (B) 1024 (C) 2048 (D) 1048 (E) – 2024

21. Let S_n be the sum of the first n terms of the series $a_1+a_2+\cdots a_n+\cdots$. If $S_n = n^2+4n$, then the n^{th} term a_n is

(A) $2n+3$ (B) $2n-1$ (C) $2n+5$ (D) $2n-3$ (E) $2n$

22. Let $t_n = \frac{1}{n}\sum_{k=1}^{n}\left(\frac{k}{n}\right)^2$ for $n = 1, 2, 3, \cdots$. Then t_{10} is equal to

(A) $\frac{7}{600}$ (B) $\frac{231}{100}$ (C) $\frac{209}{600}$ (D) $\frac{11}{200}$ (E) $\frac{77}{200}$

23. The number of arrangements containing all the seven letter of the word ALRIGHT that begins with LG is

(A) 720 (B) 120 (C) 600 (D) 540 (E) 760

24. The number of numbers greater than 6000 that can be formed from the digits 3, 5, 6, 7 and 9 (no digit is repeated in a number) is equal to

(A) 264 (B) 720 (C) 192 (D) 132 (E) 544

Space for rough work

25. The number of subsets containing exactly 4 elements of the set $\{2, 4, 6, 8, 10, 12, 14, 16, 18\}$ is equal to

(A) 126 (B) 63 (C) 189 (D) 58 (E) 94

26. If ${}^{11}P_r = 7920$ and ${}^{11}C_r = 330$, then the value of r is equal to

(A) 2 (B) 3 (C) 4 (D) 5 (E) 6

27. In the binomial expansion of $\left(x - 2y^2\right)^9$, the coefficient of x^6y^6 is equal to

(A) −672 (B) 672 (C) 336 (D) −336 (E) −512

28. Let $(3+x)^{10} = a_0 + a_1(1+x) + a_2(1+x)^2 + \cdots a_{10}(1+x)^{10}$, where $a_1, a_2, \cdots a_{10}$ are constants. Then the value of $a_0 + a_1 + a_2 + \cdots a_{10}$ is equal to

(A) 2^{20} (B) 2^{10} (C) 3^{10} (D) 2^{11} (E) 2^{15}

29. If ${}^nC_5 + {}^nC_6 = {}^{51}C_6$, then the value of n is equal to

(A) 49 (B) 50 (C) 45 (D) 46 (E) 51

30. Let $A = \begin{bmatrix} 3 & 4 \\ 1 & -2 \end{bmatrix}$ and let $AB = \begin{bmatrix} -5 & 41 \\ 5 & -13 \end{bmatrix}$. Then $|B^T| =$

(A) $\frac{1}{14}$ (B) 14 (C) 10 (D) −10 (E) −14

Space for rough work

31. Let $A=\begin{vmatrix} 2 & 1 & -2 \\ 1 & 1 & -1 \\ 1 & 0 & 3 \end{vmatrix}$ and let $B=|A|\,\text{adj}(A)$. Then $|B|=$

(A) 256 (B) 64 (C) 512 (D) 1024 (E) 128

32. The values of x satisfying the equation $\begin{vmatrix} x & 4 & 0 \\ 2 & 2 & -x \\ 1 & 1 & 1 \end{vmatrix}=0$ are

(A) 2, –4 (B) 1, 2 (C) –1, 2 (D) –1, –2 (E) –2, 4

33. If $A=\begin{bmatrix} 2 & 0 & 6 \end{bmatrix}$ and $B=\begin{bmatrix} 3 & 5 \\ 7 & -2 \\ 6 & 6 \end{bmatrix}$, then $AB=$

(A) $\begin{bmatrix} 42 & 46 \end{bmatrix}$ (B) $\begin{bmatrix} 42 \\ 46 \end{bmatrix}$ (C) $\begin{bmatrix} 6 & 10 \\ 0 & 0 \\ 36 & 36 \end{bmatrix}$

(D) $\begin{bmatrix} 17 & 19 \end{bmatrix}$ (E) $\begin{bmatrix} 2 & 12 \\ 14 & -4 \end{bmatrix}$

34. If A is non-singular matrix and if $A^{-1}=\frac{1}{2}\begin{bmatrix} -10 & -4 \\ 2 & 1 \end{bmatrix}$, then $\text{adj}(A)=$

(A) $\begin{bmatrix} -1 & -4 \\ 2 & 10 \end{bmatrix}$ (B) $\begin{bmatrix} 10 & 4 \\ -2 & -1 \end{bmatrix}$ (C) $\begin{bmatrix} 1 & 4 \\ -2 & -10 \end{bmatrix}$

(D) $\begin{bmatrix} -10 & -4 \\ 2 & 1 \end{bmatrix}$ (E) $\begin{bmatrix} -1 & -4 \\ 10 & 2 \end{bmatrix}$

Space for rough work

35. $\begin{vmatrix} \sin\alpha & \cos(\alpha+\theta) & \cos\alpha \\ \sin\beta & \cos(\beta+\theta) & \cos\beta \\ \sin\gamma & \cos(\gamma+\theta) & \cos\gamma \end{vmatrix} =$

(A) -1 (B) 1 (C) 2 (D) 4 (E) 0

36. The solution set of the inequality $-2 \le \frac{3x+2}{2} < 7$ is

(A) $\{x : 3 \le x < 4\}$ (B) $\{x : -2 \le x < 3\}$ (C) $\{x : -2 \le x < 4\}$

(D) $\{x : 0 \le x < 6\}$ (E) $\{x : -2 \le x < 6\}$

37. The set of all x satisfying the inequality $|3x+4| \le 7$ is

(A) $\left[-1, \frac{11}{3}\right]$ (B) $\left[\frac{4}{3}, \frac{7}{3}\right]$ (C) $\left[\frac{-11}{3}, 1\right]$

(D) $\left[\frac{-4}{3}, \frac{7}{3}\right]$ (E) $\left[\frac{-4}{3}, \frac{11}{3}\right]$

38. If the solution set of the inequality $|a+3x| \le 6$ is $\left[\frac{-8}{3}, \frac{4}{3}\right]$, then the value of a is equal to

(A) -1 (B) -2 (C) 4 (D) -4 (E) 2

Space for rough work

39. Consider the following statements :

(i) For every positive real number x, $x-10$ is positive.

(ii) Let n be a natural number. If n^2 is even, then n is even.

(iii) If a natural number is odd, then its square is also odd.

Then

(A) (i) False, (ii) True and (iii) True

(B) (i) False, (ii) False and (iii) True

(C) (i) True, (ii) False and (iii) True

(D) (i) True, (ii) True and (iii) True

(E) (i) False, (ii) True and (iii) False

40. If $\cos\theta = \frac{5}{11}$ and $\tan\theta < 0$, then the value of $\sin\theta$ is equal to

(A) $\frac{8\sqrt{6}}{11}$ (B) $\frac{-8\sqrt{6}}{11}$ (C) $\frac{4\sqrt{6}}{11}$ (D) $\frac{-4\sqrt{6}}{11}$ (E) $\frac{6}{11}$

41. If α and β are two acute angles of a right triangle, then

$(\sin\alpha+\sin\beta)^2+(\cos\alpha+\cos\beta)^2 =$

(A) $1+\sin 2\alpha$ (B) $2(1+\sin 2\alpha)$ (C) $1+\cos 2\alpha$

(D) $2(1+2\cos 2\alpha)$ (E) $2+\sin 2\alpha$

42. The range of the function $f(x) = 2\sin(3x)+1$ is equal to

(A) $[-1, 1]$ (B) $\left[\frac{-1}{3}, \frac{1}{3}\right]$ (C) $[-2, 1]$ (D) $[-1, 2]$ (E) $[-1, 3]$

43. The period of the function $g(x)=5\cot\left(\frac{\pi}{3}x+\frac{\pi}{6}\right)+2$ is equal to

(A) 2 (B) 3 (C) 4 (D) 5 (E) 6

Space for rough work

44. If $\theta \in (-\pi, 0)$ and $\cos\theta = \frac{-12}{13}$, then $\sin\left(\frac{\theta}{2}\right) =$

(A) $\frac{-5\sqrt{26}}{26}$ (B) $\frac{5\sqrt{26}}{26}$ (C) $\frac{-5\sqrt{13}}{13}$ (D) $\frac{5\sqrt{13}}{13}$ (E) $\frac{-5\sqrt{13}}{26}$

45. The solutions of the equation $\cos\theta = 2 - 3\sin\left(\frac{\theta}{2}\right)$ in the interval $0 \le \theta \le \pi$ are

(A) $\frac{\pi}{4}, \pi$ (B) $\frac{\pi}{3}, \frac{\pi}{2}$ (C) $\frac{\pi}{3}, \pi$ (D) $\frac{\pi}{6}, \frac{\pi}{2}$ (E) $\frac{\pi}{6}, \pi$

46. The value of $\cos^{-1}\left(\cos\left(\frac{7\pi}{6}\right)\right)$ is equal to

(A) $\frac{7\pi}{6}$ (B) $\frac{\pi}{6}$ (C) $\frac{\pi}{3}$ (D) $\frac{2\pi}{3}$ (E) $\frac{5\pi}{6}$

47. The value of $\tan\left(\sin^{-1}\left(\frac{7}{25}\right)\right)$ is equal to

(A) $\frac{18}{25}$ (B) $\frac{24}{25}$ (C) $\frac{7}{24}$ (D) $\frac{3}{4}$ (E) $\frac{7}{18}$

48. $\cos\left(\sin^{-1}\left(\frac{\sqrt{3}}{200}\right) + \cos^{-1}\left(\frac{\sqrt{3}}{200}\right)\right) =$

(A) $\frac{\pi}{3}$ (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{6}$ (D) 1 (E) 0

Space for rough work

49. The equation of the straight line parallel to $y = -3x$ and passing through the point $(3, -2)$ is

(A) $y = -3x + 7$ (B) $y = -3x + 9$ (C) $y = -3x - 11$

(D) $y = -3x - 7$ (E) $y = -3x + 11$

50. The intercepts of a line with coordinate axes are equal. If the line passes through $(2, 3)$, then its equation is

(A) $2x + 3y = 5$ (B) $x + y = 5$ (C) $5x + 5y = 1$

(D) $x + y = 6$ (E) $3x + 2y = 5$

51. If the line $y = mx + c$ is perpendicular to $y = 1 + x$ and passes through the point $(1, 2)$, then the value of c is equal to

(A) 1 (B) -1 (C) -3 (D) 3 (E) 0

52. Let $A(-1, 2)$, $B(1, 3)$ and $C(a, b)$ be collinear. If B divides AC such that $BC = 8\,AB$, then the coordinates of C are

(A) $\left(\frac{5}{4}, \frac{25}{8}\right)$ (B) $(17, 9)$ (C) $(17, 11)$ (D) $\left(\frac{5}{4}, \frac{5}{8}\right)$ (E) $(1, 11)$

53. If the lines $2x - 3y + 5 = 0$, $9x - 5y + 14 = 0$ and $3x - 7y + \lambda = 0$ are concurrent, then the value of λ is equal to

(A) 7 (B) 8 (C) 10 (D) 9 (E) 6

Space for rough work

54. The points of intersection of the line $y = x + 2$ and the circle $(x - 2)^2 + y^2 = 16$ are

(A) (−2, 0), (2, 4) (B) (−2, 4), (2, 0) (C) (4, 0), (4, 2)

(D) (4, 6), (4, −2) (E) (4, 0), (4, −2)

55. The three vertices of a triangle are (0, 0), (3, 1) and (1, 3). If this triangle is inscribed in a circle, then the equation of the circle is

(A) $2x^2+2y^2-2x-6y=0$ (B) $x^2+y^2-3x-y=0$

(C) $x^2+y^2-x-3y=0$ (D) $2x^2+2y^2-6x-2y=0$

(E) $2x^2+2y^2-5x-5y=0$

56. The equation of the circle touching the x-axis at (5, 0) and the line $y = 10$ is

(A) $x^2+y^2-10x-10y+25=0$ (B) $x^2+y^2-10x-10y-25=0$

(C) $x^2+y^2-5x-5y-5=0$ (D) $x^2+y^2-5x-5y+5=0$

(E) $x^2+y^2+10x+10y-25=0$

57. If the radius of the circle $x^2+y^2+ax+by+3=0$ is 2, then the point (a, b) lies on the circle

(A) $x^2+y^2=7$ (B) $x^2+y^2=4$ (C) $x^2+y^2=14$

(D) $x^2+y^2=28$ (E) $x^2+y^2=1$

58. If the line $2x - 3y + c = 0$ passes through the focus of the parabola $x^2 = -8y$, then the value of c is equal to

(A) 4 (B) −6 (C) 6 (D) −4 (E) 2

Space for rough work

59. The centre of the ellipse $x^2 + 7y^2 - 14x + 28y + 49 = 0$ is

(A) (7, 0) (B) (7, −4) (C) (7, −2) (D) (−7, 4) (E) (−7, 2)

60. The end points of the major axis of an ellipse are (2, 4) and (2, −8). If the distance between foci of this ellipse is 4, then the equation of the ellipse is

(A) $\frac{(x-2)^2}{32} + \frac{(y+2)^2}{36} = 1$ (B) $\frac{(x-4)^2}{32} + \frac{(y+2)^2}{36} = 1$

(C) $\frac{(x-2)^2}{36} + \frac{(y+2)^2}{32} = 1$ (D) $\frac{(x-2)^2}{32} + \frac{(y-4)^2}{36} = 1$

(E) $\frac{(x-2)^2}{36} + \frac{(y-4)^2}{32} = 1$

61. If (−1, 0) and (3, 0) are foci of an ellipse and the length of the major axis is 6, then the length of the minor axis is

(A) $\sqrt{5}$ (B) 5 (C) 10 (D) $2\sqrt{5}$ (E) 3

62. The eccentricity of the hyperbola $\frac{(x-3)^2}{9} - \frac{4(y-1)^2}{45} = 1$ is equal to

(A) $\frac{3}{\sqrt{5}}$ (B) $\frac{5}{3}$ (C) $\frac{5}{\sqrt{3}}$ (D) $\frac{5}{2}$ (E) $\frac{3}{2}$

63. If $\vec{a} \times \vec{b} = 7\hat{i} + 9\hat{j} + 10\hat{k}$ and $\vec{a} \cdot \vec{b} = -20$, then $|\vec{a}|^2 |\vec{b}|^2 =$

(A) 530 (B) 580 (C) 400 (D) 630 (E) 560

Space for rough work

64. Let $\vec{a} = \hat{i} + 2\hat{j} - 3\hat{k}$ and $\vec{a} + \vec{b} = 4\hat{i} - 2\hat{j} + \lambda\hat{k}$. If $\vec{a} \cdot \vec{b} = 4$, then the value of λ is equal to

(A) 3 (B) –3 (C) –6 (D) 6 (E) 0

65. If $|\vec{a}| = \sqrt{14}$, $|\vec{b}| = \sqrt{10}$, $|\vec{a} - \vec{b}| = \sqrt{24}$ and θ is angle between $\vec{a}$ and $\vec{b}$, then $\cos\theta =$

(A) $\frac{\sqrt{35}}{70}$ (B) $\frac{\sqrt{6}}{12}$ (C) $\frac{\sqrt{15}}{60}$ (D) $\frac{\sqrt{210}}{35}$ (E) 0

66. If $|\vec{a}| = 10$ and $|\vec{b}| = 5$, then the value of $(\vec{a} + 2\vec{b}) \cdot (\vec{a} - 2\vec{b})$ is equal to

(A) 32 (B) 16 (C) 8 (D) 4 (E) 0

67. If $\vec{a} = \hat{i} - 3\hat{j} + 3\hat{k}$ and $\vec{b} = 2\hat{i} + \hat{j} - 3\hat{k}$, then the value of $(\vec{a} \times \vec{b}) \cdot \vec{b}$ is equal to

(A) 3 (B) –3 (C) 7 (D) –7 (E) 0

68. If $\vec{a}$ and $\vec{b}$ are position vectors of the points $(\alpha, 3, 0)$ and $(1, 0, 0)$ respectively and if the angle between the vectors $\vec{a}$ and $\vec{b}$ is $\frac{\pi}{4}$, then the value of α is equal to

(A) 1 (B) 2 (C) 3 (D) 4 (E) 5

69. If $\vec{a} = 2\hat{i} + 3\hat{j} - 4\hat{k}$ and $\vec{b} = \hat{i} + 3\hat{j} + 2\hat{k}$, then a unit vector in the direction of $\vec{a} + \vec{b}$ is

(A) $\frac{1}{6}(3\hat{i} + 6\hat{j} - 2\hat{k})$ (B) $\frac{1}{\sqrt{70}}(3\hat{i} + 6\hat{j} - 5\hat{k})$

(C) $\frac{1}{7}(3\hat{i} + 6\hat{j} - 2\hat{k})$ (D) $\frac{1}{\sqrt{50}}(3\hat{i} + 6\hat{j} - 3\hat{k})$

(E) $\frac{1}{\sqrt{6}}(\hat{i} + 2\hat{j} - \hat{k})$

Space for rough work

70. If $|\vec{u}|=3$, $|\vec{v}|=2$ and $|\vec{u}\times\vec{v}|=3$, then the angle between $\vec{u}$ and $\vec{v}$ is equal to

(A) $\frac{\pi}{4}$ or $\frac{3\pi}{4}$ (B) $\frac{\pi}{6}$ or $\frac{5\pi}{6}$ (C) $\frac{\pi}{3}$ or $\frac{2\pi}{3}$ (D) $\frac{\pi}{2}$ (E) 0

71. The equation of the plane passing through the point $(-1,-2,-3)$ and perpendicular to the x-axis is

(A) $x=-1$ (B) $y=-2$ (C) $z=-3$

(D) $2x+3y=5$ (E) $x+y+z=6$

72. Let L_1 be the line joining (0, 0, 0) and (1, 2, 3) and L_2 be the line joining (2, 3, 4) and (3, 4, 5). The point of intersection of L_1 and L_2 is

(A) (0, 0, 0) (B) (1, 2, 3) (C) (2, 3, 4) (D) (3, 4, 5) (E) (1, 1, 1)

73. The equation of the line through the point (1, −1, 1) and parallel to the line joining the points (−2, 2, 0) and (−1, 1, 1) is

(A) $\frac{x-1}{-3}=\frac{y-1}{-1}=z-1$ (B) $1-x=1+y=1-z$

(C) $x+1=-(y-1)=z-1$ (D) $\frac{x-1}{-1}=\frac{y+1}{2}=\frac{z-1}{1}$

(E) $x+2=y-2=z$

Space for rough work

74. If the points (1, 0, 0), (0, 3, 0) and (0, 0, 2) lie on a plane, then the unit normal vector $\hat{n}$ to the plane is

(A) $\frac{1}{\sqrt{14}}\left(\hat{i}+3\hat{j}+2\hat{k}\right)$

(B) $\frac{1}{7}\left(2\hat{i}+3\hat{j}+6\hat{k}\right)$

(C) $\frac{1}{\sqrt{14}}\left(2\hat{i}+3\hat{j}+\hat{k}\right)$

(D) $\frac{1}{7}\left(3\hat{i}+2\hat{j}+6\hat{k}\right)$

(E) $\frac{1}{7}\left(6\hat{i}+2\hat{j}+3\hat{k}\right)$

75. The equation of the plane through the point (1, –5, 3) and having a normal vector $\bar{n}=2\hat{i}-2\hat{j}-\hat{k}$ is

(A) $2x+2y+z=9$

(B) $2x-2y-z=11$

(C) $2x+2y-z=9$

(D) $2x-2y-z=9$

(E) $2x-2y-z=13$

76. If θ is angle between the lines $\frac{x}{1}=\frac{y+1}{2}=\frac{z-1}{3}$ and $\frac{x+1}{3}=\frac{y}{2}=\frac{z}{1}$, then $\cos\theta =$

(A) $\frac{5}{9}$ (B) $\frac{5}{8}$ (C) $\frac{5}{6}$ (D) $\frac{5}{7}$ (E) $\frac{6}{7}$

Space for rough work

77. The distance from the point $(2, 2, 2)$ to the plane $2x - y + 3z = 5$ is equal to

(A) $\frac{3\sqrt{7}}{2}$ (B) $\frac{\sqrt{3}}{2}$ (C) $\frac{3\sqrt{14}}{7}$ (D) $\frac{3\sqrt{14}}{14}$ (E) $\frac{\sqrt{3}}{3}$

78. The angle between the planes $x=\sqrt{3}$ and $z = \sqrt{2}$ is equal to

(A) $\frac{\pi}{6}$ (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{3}$ (D) $\frac{\pi}{2}$ (E) 0

79. Three fair dice are rolled simultaneously. Let a, b, c be the numbers on the top of the dice. Then the probability that $\min(a, b, c)=6$ is

(A) $\frac{1}{216}$ (B) $\frac{1}{36}$ (C) $\frac{1}{6}$ (D) $\frac{11}{216}$ (E) $\frac{5}{6}$

80. If A and B are two events such that $P(A)=0.5$, $P(B)=0.4$ and $P(A\cap B)=0.2$, then $P(A|(A\cup B))$ is equal to

(A) $\frac{6}{7}$ (B) $\frac{5}{6}$ (C) $\frac{5}{7}$ (D) $\frac{4}{7}$ (E) $\frac{1}{2}$

Space for rough work

81. There are 37 men and 33 women at a party. If a prize is given to one person chosen at random, then the probability that the prize goes to a woman is

(A) $\frac{33}{70}$ (B) $\frac{32}{70}$ (C) $\frac{33}{80}$ (D) $\frac{37}{70}$ (E) $\frac{37}{80}$

82. A fair coin is tossed twice. Given that the first toss resulted in head, then the probability that the second toss also, would result in head is

(A) $\frac{1}{8}$ (B) $\frac{1}{4}$ (C) $\frac{3}{8}$ (D) $\frac{1}{2}$ (E) $\frac{5}{8}$

83. The coefficient of variation (C.V.) and the mean of a distribution are respectively 75 and 44. Then the standard deviation of the distribution is

(A) 30 (B) 31 (C) 32 (D) 33 (E) 35

84. There are 4 red, 3 blue and 3 yellow marbles in an urn. If three marbles are drawn simultaneously, then the probability that the number of yellow marbles will be less than 2 is equal to

(A) $\frac{97}{120}$ (B) $\frac{49}{60}$ (C) $\frac{47}{60}$ (D) $\frac{59}{60}$ (E) $\frac{39}{60}$

Space for rough work

85. In a box there are four marbles and each of them is marked with distinct number from the set $\{1, 2, 5, 10\}$. If one marble is randomly selected four times with replacement and the number on it noted, then the probability that the sum of numbers equals 18 is

(A) $\frac{1}{64}$ (B) $\frac{3}{16}$ (C) $\frac{5}{32}$ (D) $\frac{3}{32}$ (E) $\frac{1}{32}$

86. $\lim_{t\to 0}\left(\frac{(2t-3)(t-2)}{t} - \frac{3(t+2)}{t}\right)$ is equal to

(A) 10 (B) -10 (C) -7 (D) 7 (E) 5

87. If $f(x)=\begin{cases} x^2\sin\left(\frac{\pi}{6}x\right) & \text{for } x\le -3 \\ x\cos\left(\frac{\pi}{3}x\right) & \text{for } x>-3 \end{cases}$, then the value of $\lim_{x\to -3^+} f(x)$ is equal to

(A) 3 (B) -3 (C) 9 (D) -9 (E) 0

88. $\lim_{x\to 0}\frac{\log(1+x)+1-e^x}{4x^2-9x}$ is equal to

(A) $\frac{-1}{9}$ (B) $\frac{1}{9}$ (C) $\frac{-1}{18}$ (D) $\frac{1}{18}$ (E) 0

Space for rough work

89. $\lim_{t \to 0} \frac{\sin\left(t^2\right)}{t\sin(5t)}$ is equal to

(A) 5 (B) 25 (C) $\frac{1}{25}$ (D) $\frac{1}{5}$ (E) 0

90. Let $f(x) = \begin{cases} 3x+6, & \text{if } x \geq c \\ x^2 - 3x - 1, & \text{if } x < c \end{cases}$, where $x \in \mathbb{R}$ and c is a constant. The values of c for which f is continuous on $\mathbb{R}$ are

(A) $-7, 1$ (B) $1, 3$ (C) $-1, 7$ (D) $-1, 6$ (E) $2, -3$

91. If $\lim_{x \to -2} \frac{3x^2 + ax - 2}{x^2 - x - 6}$ is a finite number, then the value of a is equal to

(A) 2 (B) 3 (C) 4 (D) 5 (E) 6

92. If $x = \sqrt{10^{\cos^{-1}\theta}}$ and $y = \sqrt{10^{\sin^{-1}\theta}}$, then $\frac{dy}{dx}$ is equal to

(A) xy (B) $\frac{x}{y}$ (C) $\frac{y}{x}$ (D) $\frac{-x}{y}$ (E) $\frac{-y}{x}$

Space for rough work

93. If $y = e^{3\log(2x+1)}$, then $\frac{dy}{dx} =$

(A) $6e^{3\log(2x+1)}$ (B) $6\frac{e^{3\log(2x+1)}}{2x+1}$ (C) $\frac{e^{3\log(2x+1)}}{2x+1}$

(D) $\frac{e^{3\log(2x+1)}}{3(2x+1)}$ (E) $(2x+1)e^{3\log(2x+1)}$

94. If $x\sin y + y\sin x = \pi$, then $\frac{dy}{dx}$ at $\left(\frac{\pi}{2}, \frac{\pi}{2}\right)$ is equal to

(A) 1 (B) $\frac{\pi}{2}$ (C) -1 (D) $\frac{-\pi}{2}$ (E) 0

95. Let $f(x) = \begin{cases} \tan x, & \text{if } 0 \le x \le \frac{\pi}{4} \\ ax+b, & \text{if } \frac{\pi}{4} < x < \frac{\pi}{2} \end{cases}$. If $f(x)$ is differentiable at $x = \frac{\pi}{4}$, then the values of a and b are respectively

(A) $2, \frac{2-\pi}{2}$ (B) $2, \frac{4-\pi}{4}$ (C) $1, \frac{-\pi}{4}$ (D) $2, \frac{-\pi}{4}$ (E) $2, 1-\pi$

96. $\frac{d}{dx}\left(\frac{1}{x}\frac{d^2}{dx^2}\left(\frac{1}{x^3}\right)\right) =$

(A) $-36x^{-7}$ (B) $36x^{-7}$ (C) $72x^{-6}$ (D) $72x^{-7}$ (E) $-72x^{-7}$

Space for rough work

97. Air is blown into a spherical balloon. If its diameter d is increasing at the rate of 3 cm/min, then the rate at which the volume of the balloon is increasing when $d = 10$ cm, is

(A) 120π cm^3 / min
(B) 150π cm^3 / min
(C) 100π cm^3 / min
(D) 180π cm^3 / min
(E) 210π cm^3 / min

98. The equation of tangent to the circle $(x-5)^2+y^2=25$ at (2, 4) is

(A) $3x-4y+10=0$
(B) $x+y=6$
(C) $2x-y=0$
(D) $3x-2y+2=0$
(E) $3x-4y-10=0$

99. If x and y are both non-negative and if $x+y=\pi$, then the maximum value of $5\sin x \sin y$ is equal to

(A) 1
(B) $\sqrt{5}$
(C) 5
(D) –5
(E) 0

100. The normal to the curve $y=\sqrt{x}$ at the point (25, 5) intersects the y-axis at

(A) (0, 245)
(B) (0, 255)
(C) (255, 0)
(D) (245, 0)
(E) (0, 100)

Space for rough work

101. The function $f(x)=x^5e^{-x}$ is increasing in the interval

(A) $(5, \infty)$ (B) $(4, \infty)$ (C) $(-4, \infty)$ (D) $(-\infty, 5)$ (E) $(-5, \infty)$

102. If $x+13y=40$ is normal to the curve $y=5x^2+\alpha x+\beta$ at the point (1, 3), then the value of $\alpha\beta$ is equal to

(A) 15 (B) –6 (C) 6 (D) 13 (E) –15

103. Let $f(x)=\cos x$ for $0 \le x \le \frac{\pi}{3}$. Then the value of c which satisfies the conclusion of the Mean Value Theorem for the function f on $\left[0, \frac{\pi}{3}\right]$ is equal to

(A) $\sin^{-1}\left(\frac{3}{2\pi}\right)$ (B) $\sin^{-1}\left(\frac{1}{3\pi}\right)$ (C) $\sin^{-1}\left(\frac{\pi}{12}\right)$

(D) $\sin^{-1}\left(\frac{1}{6\pi}\right)$ (E) $\sin^{-1}\left(\frac{\pi}{4}\right)$

104. $\int \frac{e^{\frac{1}{\sqrt{t}}}}{t\sqrt{t}}\,dt =$

(A) $\frac{1}{2}e^{\frac{1}{\sqrt{t}}}+C$ (B) $\frac{-1}{2}e^{\frac{1}{\sqrt{t}}}+C$ (C) $2e^{\frac{1}{\sqrt{t}}}+C$

(D) $-2e^{\frac{1}{\sqrt{t}}}+C$ (E) $e^{\frac{1}{\sqrt{t}}}+C$

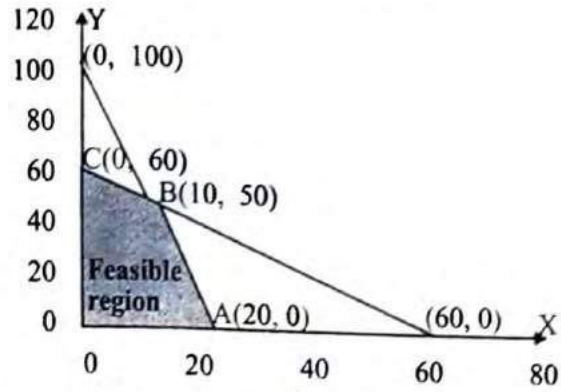
Space for rough work

105. $\int \frac{\sin^{25} x}{\cos^{27} x} dx$ is equal to

(A) $\frac{\sin^{26}(x)}{26} + C$ (B) $\frac{\cos^{26}(x)}{26} + C$ (C) $\tan^{26}(x) + C$

(D) $\frac{\tan^{26}(x)}{26} + C$ (E) $26\tan^{26}(x) + C$

106. The feasible region for a L.P.P. is shown in the figure below. Let $z = 50x + 15y$ be the objective function, then the maximum value of z is



(A) 900 (B) 1000 (C) 1250 (D) 1300 (E) 1520

Space for rough work

107. $\int \frac{1}{x^3}\sqrt{1-\frac{1}{x^2}}\,dx =$

(A) $\frac{-1}{6}\left(1-\frac{1}{x^2}\right)^{\frac{3}{2}}+C$

(B) $\frac{1}{3}\left(1-\frac{1}{x^2}\right)^{\frac{3}{2}}+C$

(C) $\frac{-1}{3}\left(1-\frac{1}{x^2}\right)^{\frac{3}{2}}+C$

(D) $\frac{4}{3}\left(1-\frac{1}{x^2}\right)^{\frac{3}{2}}+C$

(E) $\frac{-4}{3}\left(1-\frac{1}{x^2}\right)^{\frac{3}{2}}+C$

108. $\int\left(\tan^2(2x)-\cot^2(2x)\right)dx =$

(A) $\frac{-1}{2}(\tan 2x+\cot 2x)+C$

(B) $2(\tan 2x+\cot 2x)+C$

(C) $\frac{1}{2}(\tan 2x-\cot 2x)+C$

(D) $\frac{-1}{2}(\tan 2x-\cot 2x)+C$

(E) $\frac{1}{2}(\tan 2x+\cot 2x)+C$

109. $\int\sin^3 x\,dx+\int\cos^2 x\sin x\,dx =$

(A) $-\cos x+C$

(B) $-\sin x+C$

(C) $x-\cos x+C$

(D) $x-\sin x+C$

(E) $\cos x-\sin x+C$

Space for rough work

110. $\int \frac{dx}{x^2 - x} =$

(A) $\log \frac{|x|}{|x-1|} + C$

(B) $\frac{-1}{x^2} + \log|x-1| + C$

(C) $x \log|x-1| + C$

(D) $\log \frac{|x-1|}{|x|} + C$

(E) $-x \log|x-1| + C$

111. The value of $\int_{\frac{\pi}{6}}^{\frac{\pi}{2}} \frac{\cot x}{\sin x}\, dx$ is equal to

(A) $\frac{-1}{2}$ (B) $\frac{1}{2}$ (C) $\frac{-3}{2}$ (D) $\frac{3}{2}$ (E) 1

112. The area bounded by the curve $y = x(2-x)$ and the line $y = x$ is

(A) $\frac{1}{6}$ (B) $\frac{1}{3}$ (C) $\frac{1}{2}$ (D) $\frac{5}{6}$ (E) $\frac{2}{3}$

Space for rough work

113. The value of $\int_{-1}^{2}(x-2|x|)\,dx$ is equal to

(A) $\frac{-1}{2}$ (B) $\frac{-3}{2}$ (C) $\frac{-5}{2}$ (D) $\frac{-7}{2}$ (E) $\frac{-9}{2}$

114. The value of $\int_{-10}^{10}\frac{x^{10}\sin x}{\sqrt{1+x^{10}}}\,dx$ is equal to

(A) $\frac{1}{100}$ (B) $\frac{-1}{100}$ (C) $\frac{1}{50}$ (D) $\frac{-1}{50}$ (E) 0

115. If $f(x)=\begin{cases}\cos x & \text{for } x\geq 0\\ 2x & \text{for } x<0\end{cases}$, then the value of $\int_{-2}^{\frac{\pi}{2}}f(x)\,dx$ is equal to

(A) 2 (B) –2 (C) –3 (D) 3 (E) 0

Space for rough work

116. The value of $\int_0^{\frac{\pi}{16}} \cos 6x \cos 2x \, dx$ is equal to

(A) $\frac{1+\sqrt{2}}{16}$ (B) $\frac{1+\sqrt{2}}{8}$ (C) $\frac{2+\sqrt{2}}{16}$

(D) $\frac{-1+\sqrt{2}}{16}$ (E) $\frac{-1+\sqrt{2}}{8}$

117. A particular solution of the differential equation $\frac{dy}{dx} = xy^2$ with $y(0) = 1$ is

(A) $y = \frac{2-x^2}{2}$ (B) $y = \frac{2}{2-x^2}$ (C) $y = \frac{2}{x^2} - 2$

(D) $y = \frac{x^2-2}{2}$ (E) $y = \frac{2}{x^2-2}$

118. The general solution of the differential equation $(x^2y^2 + y)dx - (x - 2x^3y)dy = 0$ is

(A) $x^2y^2 - \frac{y}{x} = C$ (B) $x^3y + \frac{x}{y} = C$ (C) $xy^2 + \frac{y}{x} = C$

(D) $xy^2 - \frac{y}{x} = C$ (E) $x^2y + \frac{y}{x} = C$

Space for rough work

119. The integrating factor of the differential equation $4xdy - e^{-2y}dy + dx = 0$ is

(A) e^{-2y} (B) e^{2x^2} (C) e^{4y} (D) e^{-4y} (E) x^4

120. Consider the linear programming problem:

Maximize $z = 10x + 5y$

subject to the constraints

$2x + 3y \leq 120$

$2x + y \leq 60$

$x, y \geq 0$.

Then the coordinates of the corner points of the feasible region are

(A) (0, 0), (30, 0), (0, 40) and (15, 30)

(B) (0, 0), (60, 0), (0, 40) and (15, 30)

(C) (0, 0), (30, 0), (0, 60) and (15, 30)

(D) (0, 0), (30, 0), (0, 40) and (30, 40)

(E) (0, 0), (60, 0), (0, 40) and (30, 40)

Space for rough work

KEAM 2022 - ANSWER KEY

SUBJECT: PAPER II MATHEMATICS

VERSION CODE: B1

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2	E	22	E	42	E	62	E	82	D	102	E
3	A	23	B	43	B	63	D	83	D	103	A
4	B	24	C	44	A	64	C	84	B	104	D
5	E	25	A	45	C	65	E	85	D	105	D
6	E	26	C	46	E	66	E	86	B	106	C
7	C	27	A	47	C	67	E	87	A	107	B
8	B	28	C	48	E	68	C	88	E	108	E
9	C	29	B	49	A	69	C	89	D	109	A
10	C	30	B	50	B	70	B	90	C	110	D
11	B	31	D	51	D	71	A	91	D	111	E
12	A	32	E	52	C	72	B	92	E	112	A
13	B	33	A	53	C	73	B	93	B	113	D
14	E	34	B	54	A	74	E	94	C	114	E
15	B	35	E	55	E	75	D	95	A	115	C
16	D	36	C	56	A	76	D	96	E	116	A
17	D	37	C	57	D	77	D	97	B	117	B
18	D	38	E	58	B	78	D	98	A	118	D
19	B	39	A	59	C	79	A	99	C	119	C
20	C	40	D	60	A	80	C	100	B	120	A