Q.B. Series:

A

Common Entrance Test (Engineering) - 2017
QUESTION BOOKLET

Q.B. Number:

500205

INSTRUCTIONS

Maximum Time Allowed : 3 Hours
No. of Questions: 180
Negative Marking : 0.25

Maximum Marks: 180

Roll Number: | | | | | | | | | Answer Sheet Number: | | | | | | | | |

Please read the following instructions carefully:

1) **Check the booklet thoroughly**: In case of any defect – Misprint, missing question(s) or duplication of question(s) / Page(s), get the booklet changed with the booklet of the same series from the Room Invigilator. No complaint shall be entertained after the entrance test.

2) Write your Roll Number and the OMR Answer Sheet Number on the question booklet.

3) Mark carefully your Roll Number, Question Booklet Number, Paper Code, Question Booklets series and Course on the OMR Answer sheet and sign at the appropriate place. If you have committed any mistake in making these entries, you must immediately report to the Room Invigilator. You can also make representation to the Controller of Examinations within 3 days after conclusion of the test for rectifying this mistake, failing which no such claim will be entertained afterwards.

4) Strictly follow the instructions given by the Centre Supervisor / Room Invigilator and those given on the Question Booklet.

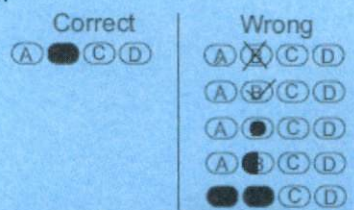
5) Candidates are not allowed to carry any papers, notes, books, calculators, cellular phones, scanning devices, pagers etc. to the Examination Hall. Any candidate found using, or in possession of such unauthorized material, indulging in copying or impersonation or adopting unfair means / reporting late / without Admit Card will be debarred from the written test.

6) Please mark the right responses on the OMR Sheet with ONLY a Blue/Black ball point pen. Use of eraser, whitener (fluid) and cutting on the OMR Answer Sheet is NOT allowed.

7) The test is of objective type containing multiple choice questions (MCQs). Each objective question is followed by four responses. Your task is to choose the correct/best response and mark your response on the OMR Answer Sheet and NOT on the Question Booklet.

8) There will be **0.25** negative marking for every wrong answer.

9) For marking response to a question, completely darken the CIRCLE so that the alphabet inside the CIRCLE is not visible. Darken only ONE circle for each question. If you darken more than one circle, it will be treated as wrong answer. The CORRECT and the WRONG methods of darkening the CIRCLE on the OMR Answer Sheet are shown below.



10) Please be careful while marking the response to questions. The response once marked cannot be changed and if done shall be treated as wrong answer.

11) In view of the tight time span, do NOT waste your time on a question which you find to be difficult. Attempt easier questions first and come back to the difficult questions later during the test.

12) DO NOT make any stray marks anywhere in or around the oval on the OMR Answer Sheet. It will be read as double shading and will make answer invalid. DO NOT fold or wrinkle the OMR Answer Sheet.

13) Rough work MUST NOT be done on the OMR Answer Sheet. Use your test booklet for this purpose.

14) Candidates are provided carbonless OMR Answer Sheet having original copy and candidate's copy. After completing the examination, candidates are directed to fold at perforation on the top of the sheet, tear it to separate original copy and candidate's copy and then hand over the original copy of OMR Answer Sheet to the Room Invigilator and take candidate's copy with them.

DO NOT OPEN THE SEAL OF THIS BOOKLET UNTIL TOLD TO DO SO

Section 1 - Physics

1) In a Young's double slit experiment, the two slits which are separated by 1.2 mm are illuminated with a monochromatic light of wavelength 6000 angstorm. The interference pattern is observed on a screen placed at a distance of 1m from the slits. Find the number of bright fringes formed over 1 cm width on the screen

A) 25
B) 12
C) 15
D) 20

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2) The energy stored in an inductor of "L" henry when it carries a current of "I" ampere is

A) LI^2
B) (1/2) LI
C) L^2I^2
D) (1/2) LI^2

---

3) A body of mass 5 kg acquires an angular acceleration of 10 rad/s^2 by an applied torque of 2 Nm. Find its radius of gyration.

A) 2.5 m
B) $\sqrt{2.5}$ m
C) $\sqrt{0.2}$ m
D) 0.2 m

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4) The deflections produced by a Tangent Galvanometer at two different places when the same current is passed through it are 45° and 60° respectively. The ratio of the values of B_H at two places is

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

---

5) The kinetic energy of electron and photon are the same. The relation between their De-Broglie wavelengths λ_e and λ_p is

A) $\lambda_e = \lambda_p$
B) $\lambda_e < \lambda_p$
C) $\lambda_e > \lambda_p$
D) $\lambda_e = 2\lambda_p$

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6) If $B_H = 4 \times 10^{-5}$ T and $B_v = 2 \times 10^{-5}$ T, then the Earth's total field at the place is (in T):

A) 6×10^{-5} T
B) $2\sqrt{5} \times 10^{-5}$ T
C) 4×10^{-5} T
D) 3×10^{-5} T

7) Two simple pendulums of lengths in the ratio 4:1 start oscillating at t= 0. They will again be in phase after the shorter pendulum has made "n" oscillations. Find the value of n.

A) 2
B) 1.5
C) 2.5
D) 1

---

8) A cell of negligible internal resistance and emf 2.5 V is connected to a series combination of 1 Ω, 1 Ω and 3Ω. The potential difference across 3Ω resistance is

A) 7.5 V
B) 2 V
C) 1.5 V
D) 2.5 V

---

9) A body A thrown vertically upwards with a velocity "v" reaches a height of 200 m. Another body B whose mass is twice that of A is thrown with a velocity 2v. Find the maximum height reached by B.

A) 400 m
B) 800 m
C) 100 m
D) 200 m

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10) A conveyer belt moves at a steady rate of 2m/s. Sand is poured on the belt at 5 kgm/s. Find the constant force required to maintain the speed of the belt.

A) 3 N
B) 7 N
C) 2.5 N
D) 10 N

---

11) A bird flies at an angle of 60° to the horizontal. Its horizontal component of velocity is 10 m/s. Find its vertical component of velocity in m/s.

A) $10\sqrt{3}$
B) $10/\sqrt{3}$
C) 5
D) 26

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12) Matter waves are

A) mechanical waves
B) electromagnetic waves
C) photons
D) waves associated with a moving particle under suitable conditions

13) A projectile is fired at an angle of 45° and reaches the highest point in its path after $2\sqrt{2}$s. Find the velocity of projectile in m/s.

A) 19.6
B) 39.2
C) 9.8
D) 4.9

14) The electric intensity and electric potential at a certain distance "r" from a point charge in air are 150 V/m and 300 V respectively. Find the distance "r".

A) 2 m
B) 4 m
C) 0.5 m
D) 0.4 m

15) Two planets are at distances R_1 and R_2 from the Sun. Their periods are T_1 and T_2. $(T_1/T_2)^2$ is equal to

A) R_1 / R_2
B) $(R_1 / R_2)^2$
C) $(R_1 / R_2)^3$
D) $(R_2 / R_1)^3$

16) Twelve wires, each of resistance 2Ω are connected to form a cube. Find the equivalent resistance between the adjacent corners of any face of the cube

A) 6/7 Ω
B) 7/6 Ω
C) 3/4 Ω
D) 4/3 Ω

17) The transistor parameters, namely α and β of a transistor are related as

A) $1/\alpha + 1/\beta = 1$
B) $1/\alpha = \beta + 1/\beta$
C) $1/\alpha - 1/\beta = 0$
D) $1/\alpha - 1/\beta = 1$

18) The motion of a particle is represented by the equation $S = 8t^3 - 2t^2 + 6t + 7$. Find the velocity of the particle at the end of 2 seconds in m/s.

A) 108
B) 57
C) 94
D) 41

19) A graph of pressure (P) against volume (V) of an ideal gas undergoing an isothermal process is

A) a straight line passing through the origin
B) a parabola
C) a rectangular hyperbola
D) a straight line parallel to pressure axis

20) "n" identical capacitors are joined in parallel and charged to a potential V. The charged capacitors are disconnected and then connected in series using insulating handles such that the positive plate of one is connected to the negative plate of the other. The potential difference across the free plates of the combination is

A) V
B) V/n
C) nV
D) (n+1) V

21) When a simple pendulum is moved from the Earth's surface to deep mine, the period of oscillation

A) remains the same
B) decreases
C) increases
D) becomes zero

22) The dimensional formula $[ML^2T^{-2}]$ represents

A) moment of force
B) force
C) acceleration
D) momentum

23) 64 identical water droplets combine to form a large drop. Find the ratio of the total surface energy of 64 droplets to that of the large drop.

A) 64 : 1
B) 4 : 1
C) 8 : 1
D) 1 : 8

24) Four point charges of +3 μC, +2 μC, +3 μC and +2 μC are placed at the corners of a rectangle A, B,C and D. The electrical force will be least between the charges

A) A and D
B) B and D
C) A and C
D) C and D

25) An ideal Carnot's engine works between 227° and 57° C. Find the efficiency of the engine.

A) 22%
B) 34%
C) 55%
D) 13.5%

26) A lift moves vertically up with an acceleration "a". Force exerted by a person of mass M on the floor of the lift is

A) Ma
B) Mg
C) M(g + a)
D) M(g - a)

27) A transistor is preferred to a triode valve in amplifier circuit because it

A) can withstand larger changes in temperature
B) has higher input resistance
C) can handle larger voltages
D) is compact and does not require a heater

28) The electric intensities at a point due to two point charges in the x-y plane are 3i - 2j and -2i + 4j. The magnitude of the resultant intensity at that point is

A) 2.08 V/m
B) 2.24 V/m
C) 1.8 V/m
D) 3.5 V/m

29) A body of mass 2 kg is thrown vertically up so that its kinetic energy is 490 J. ($g = 9.8\ m/s^2$). The height at which the kinetic energy becomes half the original value is

A) 10 m
B) 12.5 m
C) 25 m
D) 50 m

30) A converging lens has a focal length of 0.12m. To get an image of unit magnification the object should be placed at what distance from the converging lens?

A) 0.24 m
B) 0.12 m
C) 0.06 m
D) 0.4 m

31) A solid cylinder of mass M and radius R rolls on a flat surface. Find its moment of inertia about the line of contact.

A) $(3/2)\ MR^2$
B) MR^2
C) $2\ MR^2$
D) $(2/3)\ MR^2$

32) A coil of inductance L is divided into four equal parts and all the parts are connected in parallel. The effective inductance of the combination is

A) L/4
B) L/8
C) L/16
D) 4L

33) The kinetic energy of a body is increased by 300%. Its momentum increases by

A) 100 %
B) 150 %
C) 200 %
D) 300 %

34) The angular position of the first minimum is of diffraction pattern is

A) $\lambda/2a$
B) a/λ
C) λ/a
D) $2\lambda/a$

35) A very long conductor carries a current of 1A. The magnetic field at a point whose distance is 0.1m from one end of the conductor is (in T)

A) 10^{-7}
B) 2×10^{-6}
C) 10^{-3}
D) 10^{-2}

36) Pick out the correct statement from the following

A) The β of a refrigerator is higher when the difference in temperature between the inside and outside regions is smaller
B) The value of β may be much higher than 100%
C) As the refrigerator works, β increases due to the formation of ice
D) It is necessary to defrost the refrigerator to increase the value of β

37) Find the percentage increase in resistance of a wire when it is stretched uniformly so that its length increases by 0.5 %.

A) 1%
B) 2%
C) 2.5%
D) 3%

38) Digital circuits can be made with the repetitive use of

A) OR gates
B) AND gates
C) NOT gates
D) NAND gates

39) The absolute temperature of a gas is increased to 16 times of the original temperature. The rms speed of its molecules will become

A) 4 times
B) 16 times
C) 64 times
D) 256 times

40) The velocity of escape on a planet whose radius is 1.7×10^6 m and acceleration due to gravity is $1.7\ m/s^2$ is

A) 1.7 km/s
B) 2.89 km/s
C) $1.7\ \sqrt{2}$ km/s
D) 3.4 km/s

41) Total energy of a particle of mass 'm' executing SHM given by y = a sin ωt for any displacement is:

A) $m\omega^2A^2$
B) $(1/2)\, m\omega^2A^2$
C) $m\omega^2A$
D) $(1/2)\, m\omega^2A$

42) An electron revolves round a nucleus of charge Ze. 40.8 eV of energy is needed to excite an electron from n=1 to n=2 state. Find the value of Z.

A) 2
B) 4
C) 6
D) 8

43) Select the correct statement from the following:

A) The magnetic dip is zero at the centre of the earth
B) Magnetic dip decreases as we move away from the equator towards the magnetic pole
C) Magnetic dip increases as we move away from the equator towards the magnetic pole
D) Magnetic dip does not vary from place to place

44) A wire of Young's modulus Y is subjected to a stress S. The elastic potential energy per unit volume of the wire is given by

A) SY/2
B) $S^2/2Y$
C) Y/2S
D) $2Y/S^2$

45) Choose the correct statement in the following:

(a) The magnetic field inside the solenoid is greater than that of outside
(b) The magnetic field inside an ideal solenoid is not at all uniform
(c) The magnetic field at the centre, inside an ideal solenoid is almost twice that at the ends
(d) The magnetic field at the centre, inside an ideal solenoid is almost half of that at the ends

A) only (a) is correct
B) only (c) is correct
C) both (a) & (c) are correct
D) only (d) is correct

46) The wavelength of electromagnetic wave of frequency 5×10^{14} Hz is (in angstrom) is:

A) 5000
B) 3500
C) 6200
D) 6000

47) When the complete Young's double slit experiment is immersed in water, the fringes

A) remain unaltered
B) become wider
C) become narrower
D) disappear

48) The refractive index 'n' and the polarizing angle 'θ_p' of a medium are related as

A) $\theta_p = \sin^{-1}(n)$
B) $\theta_p = \tan^{-1}(n)$
C) $\theta_p = \sin^{-1}(1/n)$
D) $\theta_p = \tan^{-1}(1/n)$

49) A resistance of 5 Ω is connected in series with a capacitance of 1mF. The combination is connected to AC source of angular frequency 200 $rads^{-1}$. Then

A) the voltage leads the current by 45°
B) the current leads the voltage by 45°
C) the current leads the voltage by 60°
D) the voltage leads the current by 60°

50) Two waves of the same kind and of the same amplitude A superpose at a point with a phase difference of φ between them. Find the resultant amplitude (R).

A) $2A \sin(\varphi/2)$
B) $2A \cos(\varphi/2)$
C) $2A\, 2\varphi$
D) $A\sqrt{2} \cos \varphi$

51) In Young's double slit experiment, if one of the slits is covered with a microscope cover slip, then

A) fringe pattern disappears
B) the screen just gets illuminated
C) in the fringe pattern, the brightness of the bright fringes will decrease and the dark fringes will become more dark
D) bright fringes will be more bright and dark fringes will become more dark

52) The difference between the maximum and minimum values of resistance of a resistor with the color scheme green-green-red-silver is

A) 55 Ω
B) 1100 Ω
C) 44 Ω
D) 440 Ω

53) Energy of an electron in the lowest energy state of the hydrogen atom = 13.6 eV. Find the energy needed to remove an electron from the fourth orbit.

A) 13.6 eV
B) 0.85 eV
C) 10.2 eV
D) 6.8 eV

54) For a given frequency, the inductive reactance of a coil at 100 H is 25Ω. For the same frequency, the inductance reactance at 200 H will be

A) 25Ω
B) 50Ω
C) 100Ω
D) zero

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55) The Electric field and magnetic field in electromagnetic waves are

A) parallel to the wave's direction of travel as well as to each other
B) parallel to the waves direction of travel and perpendicular to each other
C) perpendicular to the wave's direction of travel and parallel to each other
D) perpendicular to the wave's direction of travel and also to each other

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56) Electrons behave like gas in J.J. Thompson experiment because they

A) ionise the gas
B) are effected by electric field
C) are deflected by magnetic field
D) diffracted by a crystal

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57) An extrinsic semiconductor with electrons as majority carriers can be obtained by doping Ge or Si with

A) bismuth
B) boron
C) indium
D) gallium

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58) When $_{92}U^{235}$ undergoes fission, about 0.1% of the original mass is converted into energy. The energy released when 1 kg of $_{92}U^{235}$ undergoes fission is

A) 9×10^{11} J
B) 9×10^{13} J
C) 9×10^{15} J
D) 9×10^{18} J

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59) Which of the following is the indirect way of generating FM?

A) Reactance FET modulator
B) Varactor diode modulator
C) Armstrong modulator
D) Reactance bipolar transistor modulator

60) Amplitude modulation is the process of

A) superimposing a high frequency signal on a low frequency carrier signal
B) superimposing a low frequency signal on a high frequency carrier signal
C) single-sideband communication
D) amplitude shift and phase shift

Section 2 - Chemistry

61) Which of the following is NOT true in case of reaction with heated copper at 573 K ?

A) Phenol → benzyl alcohol
B) primary alcohol → aldehyde
C) secondary alcohol → ketone
D) tertiary alcohol → olefin

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62) The correct order of electrical conductivity of the given complexes is

A) $[Ni(NH_3)_4Cl_2] < K_2[PtCl_6] < K_4[Fe(CN)_6] < [Co(NH_3)_4Cl_2]Cl$
B) $K_2[PtCl_6] < K_4[Fe(CN)_6] < [Co(NH_3)_4Cl_2]Cl < [Ni(NH_3)_4Cl_2]$
C) $K_4[Fe(CN)_6] < [Co(NH_3)_4Cl_2]Cl < [Ni(NH_3)_4Cl_2] < K_2[PtCl_6]$
D) $[Ni(NH_3)_4Cl_2] < [Co(NH_3)_4Cl_2]Cl < K_2[PtCl_6] < K_4[Fe(CN)_6]$

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63) The colligative properties of a dilute solution depend upon

A) the nature of solute
B) the diffusion of solvent
C) the number of particles of solute
D) the number of particles of solvent

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64) Which of the following elements involves gradual filling of 4*f*- levels?

A) Lanthanides
B) Actinides
C) Transition metals
D) Coinage metals

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65) What will be the product obtained when $(CH_3)_2CHCHO$ is treated with NaOH at 200 °C?

A) $(CH_3)_2CHCO_2Na$ and $(CH_3)_2CHCH_2OH$
B) $(CH_3)_2CHCO_2H$
C) $(CH_3)_2CHCH_2OH$
D) $(CH_3)_2C(CHO)\text{-}CH(OH)CH(CH_3)_2$

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66) What will be the spin only magnetic moment of high spin and low spin d^5 electronic systems in an octahedral complex?

A) $\mu_{high\ spin}$ = 1.73 BM and $\mu_{low\ spin}$ = 5.92 BM
B) $\mu_{high\ spin}$ = 5.92 BM and $\mu_{low\ spin}$ = 1.73 BM
C) $\mu_{high\ spin}$ = 4.9 BM and $\mu_{low\ spin}$ = 2.83 BM
D) $\mu_{high\ spin}$ = 1.73 BM and $\mu_{low\ spin}$ = 1.73 BM

67) Which one of the following processes does NOT use adsorption?

A) Froth floatation process
B) Chromatography
C) Decolourisation of sugar liquors
D) Dissolution of sugar in water

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68) Hydrogen bonding is NOT present in

A) glycerine
B) water
C) hydrogen sulphide
D) hydrogen fluoride

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69) There are two statements, one labelled as Assertion (A) and the other as Reason (R). Examine both the statements carefully and mark the correct choice.

(A) At equilibrium, the mass of each of the reactants and products remains constant.
(R) At equilibrium, the rate of forward reaction is equal to the rate of backward reaction.

A) Both (A) and (R) are correct and (R) is the correct explanation of (A)
B) Both (A) and (R) are correct but (R) is not the correct explanation of (A)
C) (A) is correct but (R) is wrong
D) (A) is wrong but (R) is correct

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70) For the reaction, $CO\ (g) + H_2O = CO_2\ (g) + H_2\ (g)$ at a given temperature the equilibrium amount of CO_2 (g) can be increased by

A) adding a suitable catalyst
B) adding an inert gas
C) increasing the volume of the container
D) increasing the amount of CO (g)

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71) At 25 °C consider the density of water is 1 g/L and that of propanol to be 0.925 g/L. What volume of propanol will have same number of molecules as present in 210 mL of water?

A) 757 mL
B) 825 mL
C) 646 mL
D) 437 mL

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72) What will be the product formed when 1-methyl cyclopentene is treated with BH_3 and $H_2O_2\text{-}OH^-$?

A) 1-methyl cyclohexanol
B) 2-methyl cyclohexanal
C) 1-methyl cyclohexenol
D) 2-methyl cyclohexanol

73) The geometry and type of hybrid orbital present around the central atom in BF_3 is

A) linear, sp
B) trigonal planar, sp^2
C) tetrahedral, sp^3
D) pyramidal, sp^3

74) What is the correct order of bond strength for NO, NO^+ and NO^-?

A) $NO > NO^+ > NO^-$
B) $NO^+ > NO > NO^-$
C) $NO^- > NO > NO^+$
D) $NO^+ > NO^- > NO$

75) What will be the molar entropy change when silver is heated from 227 °C to 727 °C?

Consider the molar specific heat of Ag, $C_p = 5.3 + 0.0028T$

A) 7.873 eu
B) 12.341 eu
C) 3.214 eu
D) 5.074 eu

76) Phosphorus pentoxide (P_2O_5) is the starting material for phosphate esters used as surfactants and extraction agents. P_2O_5 is extensively used as

A) reducing agent
B) preservative
C) oxidising agent
D) dehydrating agent

77) What are the monomers of polyester?

A) Caprolactum
B) Terephthalic acid and ethylene glycol
C) Dimethylester of terephthalic acid
D) Hexamethylene diamine and adipic acid

78) There are two statements, one labelled as Assertion (A) and the other as Reason (R). Examine both the statements carefully and mark the correct choice.

(A) Hydrogen has one electron in its orbit but it produces several spectral lines.
(R) There are many excited energy levels available.

A) Both (A) and (R) are correct and (R) is the correct explanation of (A)
B) Both (A) and (R) are correct but (R) is not the correct explanation of (A)
C) (A) is correct and (R) is wrong
D) (A) is wrong and (R) is correct

79) The viscosity of a liquid can be increased by

A) increasing the temperature
B) increasing the pressure
C) decreasing the pressure
D) heating beyond critical temperature

80) Which of the following is an octahedral molecule?

A) SF_6
B) BF_4^-
C) PCl_5
D) IF_7

81) A type of defect observed in stoichiometric compounds is Schottky defect. Schottky defect occur mainly in ionic compounds where

A) positive and negative ions are of different sizes
B) positive and negative ions are of same sizes
C) positive ions are small and negative ions are big
D) positive ions are big and negative ions are small

82) Let the energy of an n^{th} orbit of H atom be $-21.76 \times 10^{-19}/n^2$ J. What will be the longest wavelength of energy required to remove an electron from the third orbit?

A) 0.628 nm
B) 1.326×10^{-7} m
C) 0.798 pm
D) 0.821 μm

83) Which one of the following options is CORRECT for the spontaneity of the reaction?

A) ΔG = positive (+ve); ΔH = positive (+ve)
B) ΔH = positive (+ve); ΔS = negative (-ve)
C) ΔG = negative (-ve); ΔS = negative (-ve)
D) ΔG = negative (-ve); ΔS = positive (+ve)

84) What should be the correct order of lattice energy values of the following alkali halides?

LiCl, KI, KCl and NaCl

A) KI > KCl > NaCl > LiCl
B) NaCl > KCl > LiCl > KI
C) LiCl > KCl > KI > NaCl
D) LiCl > NaCl > KCl > KI

85) According to the expression $\Delta G^\circ = -nFE^\circ$, the cell reaction is spontaneous when

(Notations and symbols carry their usual meanings)

A) ΔG° is positive
B) ΔG° is zero
C) E° is negative
D) E° is positive

86) What will be the pH at which precipitation of $Zn(OH)_2$ will take place from a solution containing 0.3 M Zn^{2+} ion? K_{sp} of $Zn(OH)_2 = 1.2x10^{-12}$

A) 5.7
B) 8.3
C) 11.4
D) 6.2

87) What is the probable free amino acid product formed when $R^1CH(NH_2)CONHCHR^2COOH$ reacts with 1-fluoro-2,4-dinitrobenzene in presence of $NaHCO_3$ followed by acid hydrolysis?

A) $R^1CH(NH_2)COOH$
B) NH_2CHR^2COOH
C) $R^1CH(NH_2)COOH + NH_2CHR^2COOH$
D) $NH_2CR^1R^2COOH$

88) What will be the CORRECT order of the C-F bond distance among the following?

CHF_3, CF_4, CH_3F and CH_2F_2

A) $CH_3F < CH_2F_2 < CHF_3 < CF_4$
B) $CH_2F_2 > CH_3F > CHF_3 > CF_4$
C) $CH_3F > CH_2F_2 > CHF_3 > CF_4$
D) $CH_3F > CHF_3 > CF_4 > CH_2F_2$

89) What will be the order of the reaction for hydrolysis of methylacetate with NaOH by using the data provided?

Time (min) 0 5 10 15
Vol of acid (mL) 10.12 6.24 1.40 0.981

A) 1
B) 2
C) 0
D) 3

90) Which of the following pairs of organic compounds give positive Tollen's test?

A) Formic acid, acetone
B) Formic acid, ethanal
C) Ethanal, acetone
D) Formic acid, acetic acid

91) What will be the boiling point of 30 g benzene containing 0.75 g of benzoic acid which undergoes 75% dimerization? Boiling point of pure benzene = 80.1 °C and $K_b = 2.53\ Kmol^{-1}kg$

A) 90.52 °C
B) 104.35 °C
C) 76.12 °C
D) 80.42 °C

92) The correct electronic configuration of d^4 in low spin state according to Crystal Field Splitting theory is

A) $t_{2g}^4\ e_g^0$
B) $t_{2g}^3\ e_g^1$
C) $t_{2g}^2\ e_g^2$
D) $t_{2g}^1\ e_g^3$

93) What will be the value of activation energy (E_a in kJ) and rate constant (k in min^{-1}) for the given equation at 27 °C? The equation: $\ln k = -2576/T + 12.1$

A) $E_a = 21.416$ kJ and $k = 0.335x10^2\ min^{-1}$
B) $E_a = 11.46$ kJ and $k = 0.335x10^2\ min^{-1}$
C) $E_a = 20.23$ kJ and $k = 0.43x10^2\ min^{-1}$
D) $E_a = 21.416$ kJ and $k = 1.44x10^2\ min^{-1}$

94) Compounds A and C in the following reaction are

$$CH_3CHO \xrightarrow[(ii)\ H_2O]{(i)\ CH_3MgBr} (A) \xrightarrow{H_2SO_4,\ \Delta} (B) \xrightarrow[\text{oxidation}]{\text{Hydroboration}} (C)$$

A) identical
B) positional isomers
C) optical isomers
D) functional isomers

95) IF_7 is known to exist while BrF_7 does not exist. The reason is

A) stability of higher oxidation state increases with the size
B) Br is more electronegative than I
C) Br cannot gain 7 electrons
D) I can easily react with F

96) What will be the $\Delta H°$ and $\Delta S°$ values for the given cell having E° at 20 °C and 30 °C to be 0.18V and 0.28 V respectively?

The cell: (Pt) H_2/H^+// $KCl/Hg_2Cl_2/Hg$ (Given: 1F = 96500 Coulombs)

A) $\Delta S° = 2017\ JK^{-1}$ and $\Delta H° = 630.54$ kJ
B) $\Delta S° = -4532\ JK^{-1}$ and $\Delta H° = 768.73$ kJ
C) $\Delta S° = 3425\ JK^{-1}$ and $\Delta H° = -530.75$ kJ
D) $\Delta S° = 1930\ JK^{-1}$ and $\Delta H° = 530.75$ kJ

97) There are two statements, one labelled as Assertion (A) and the other as Reason (R). Examine both the statements carefully and mark the correct choice.

(A) The O-H bond angle in H_2O is greater than S-H bond angle in H_2S.
(R) Due to larger size of S, hydrogen bonding does not occur in H_2S.

A) Both (A) and (R) are correct and (R) is the correct explanation of (A)
B) Both (A) and (R) are correct but (R) is not the correct explanation of (A)
C) (A) is correct but (R) is wrong
D) (A) is wrong but (R) is correct

98) α-Tocopherol belongs to vitamin-E group. It is a derivative of which of the following organic compounds?

A) Coumaran
B) Nicotinic acid
C) Pyridoxine
D) Cyanocobalamin

99) Cu crystallizes as face centred cubic lattice with edge length of 3.56 Å. What will be the nearest distance between Cu atoms?

A) 1.5 Å
B) 2.5 Å
C) 3.7 Å
D) 4.8 Å

100) What will be the enthalpy of formation of toluene considering the data given?

Bond energies of C-C = 79 kcal, C=C = 135 kcal, C-H = 102 kcal, heat of atomisation of C = 156.8 kcal and heat of atomisation of H = 49.5 kcal

A) -43.4 kcal
B) 43.4 kcal
C) 114.6 kcal
D) -114.6 kcal

101) A common observation seen in Fe_3O_4 is that it is ferrimagnetic at room temperature but at 850 K it becomes

A) Diamagnetic
B) Paramagnetic
C) Ferromagnetic
D) Non- magnetic

102) How and which alkylcyanide will produce 2-butanone?

A) $CH_3CH_2MgBr + CH_3CH_2CN$
B) $CH_3CH_2CH_2CN$ reduced with $LiAlH_4$
C) $CH_3CH_2CH_2CN$ reduced with $SnCl_2$-HCl followed by hydrolysis
D) $CH_3CH_2MgBr + CH_3CN$

103) Why is F_2 the strongest oxidizing agent (among halogens) although electron affinity of Cl_2 is higher than F_2?

A) Low enthalpy of dissociation and high free energy of hydration
B) Low enthalpy of dissociation
C) High free energy of hydration
D) High electronegativity and low free energy of hydration

104) Thermodynamic properties are divided into two broad types: intensive properties and extensive properties. Which of the following is NOT an intensive property?

A) Pressure
B) Volume
C) Temperature
D) Density

105) How many bridging carbonyl(s) is/are present in the compound $Fe_3(CO)_{12}$ compound?

A) Three
B) Four
C) Two
D) Five

106) The order of stability of the following alkenes with the first being the most stable and last being the least stable is

I $CH_3CH_2CH=CH_2$
II $(CH_3)_2C=C(CH_3)_2$
III $CH_3CH=C(CH_3)_2$
IV $(CH_3)_2C=CH_2$

A) I > II > III > IV
B) II > III > IV > I
C) IV > III > II > I
D) III > IV > I > II

107) There are four conformational isomers of n-butane: Eclipsed, Fully eclipsed, Gauche, Staggered

Arrange these isomers of n-butane in increasing order of energy.

A) Gauche < Eclipsed < Staggered < Fully eclipsed
B) Staggered < Gauche < Eclipsed < Fully eclipsed
C) Fully eclipsed < Eclipsed < Gauche < Staggered
D) Gauche > Eclipsed < Staggered < Fully eclipsed

108) What product forms when $(CH_3)_2C(OH)CH_2CH_3$ is treated with Cu at 300 °C?

A) $(CH_3)_2C(=O)CH_2CH_3$
B) $(CH_3)_2C(=O)C(=O)CH_3$
C) $(CH_3)_2CH_2CH_2CH_3$
D) $(CH_3)_2C=CHCH_3$

109) What is the IUPAC nomenclature of vanillin used as a flavouring agent in ice-cream?

A) 3-chloro-4-methoxy benzoic acid
B) 4,6-dimethoxy benzaldehyde
C) 3,4-dihydroxy benzaldehyde
D) 4-hydroxy-3-methoxy benzaldehyde

110) Under what condition, will x/m value be equal to pressure of the gas on the surface of the absorbent?

A) At low pressure
B) At high pressure
C) At low temperature
D) At high temperature

111) Allene (C_3H_4) contains

A) one triple and two double bonds
B) two double and four single bonds
C) two triple and one double bond
D) one double and one triple bond

112) Which of the conditions correctly represents product formation in the reaction between B_2H_6 and NH_3?

A) When the ratio between B_2H_6 and NH_3 at high temperature is 1:1, borazine is produced
B) When the ratio between B_2H_6 and NH_3 at high temperature is 1:2, borazine is produced
C) Excess NH_3 with B_2H_6 at low temperature produces boron nitride
D) Excess NH_3 with B_2H_6 at high temperature produces $B_2H_6.2NH_3$

113) The distinction between primary, secondary and tertiary amines can be done experimentally by using

A) Hinsberg's reagent
B) Lucas reagent
C) Benedict's reagent
D) Tollen's reagent

114) What should be possible d-orbital energy levels of Ni in $[Ni(CN)_4]^{2-}$?

A) $d_{z2} < d_{xy} < d_{xy} = d_{yz} < d_{x2-y2}$
B) $d_{x2-y2} < d_{xy} < d_{z2} < d_{xy} = d_{yz}$
C) $d_{xy} = d_{yz} < d_{z2} < d_{xy} < d_{x2-y2}$
D) $d_{z2} < d_{xy} = d_{yz} < d_{xy} < d_{x2-y2}$

115) What will be the correct nucleophilicity order in protic or aprotic solvents?

A) $SH^- > CN^- > I^- > OH^-$ in aprotic solvent
B) $CN^- > SH^- > OH^- > I^-$ in protic solvent
C) $SH^- > CN^- > I^- > OH^-$ in protic solvent
D) $I^- > Br^- > Cl^- > F^-$ in aprotic solvent

116) Hoffmann's bromamide reaction is used to

A) prepare tertiary amine
B) prepare all types of amines
C) step up the series
D) step down the series

117) What is the hydrolysis product of sucrose?

A) Fructose and glucose
B) Glucose and galactose
C) Galactose and fructose
D) Lactose and glucose

118) When each of the aldopentoses are stepped up by one carbon atom by Kiliani reaction followed by oxidation with HNO_3, optically active or inactive dicarboxylic acids are produced. Which of the following is TRUE?

A) D-ribose produces two optically active dicarboxylic acids
B) D-arabinose produces two optically active dicarboxylic acids
C) D-xylose produces one optically active and one optically inactive dicarboxylic acid
D) D-lyxose produces two optically inactive dicarboxylic acids

119) Which combination will produce polyurethane polymers?

A) $C_6H_5\text{-}CH_2\text{-}C_6H_5\text{-}N{=}C{=}O + HO\text{-}CH_2\text{-}CH_2\text{-}OH$
B) $O{=}C{=}N\text{-}C_6H_4\text{-}CH_2\text{-}C_6H_4\text{-}N{=}C{=}O + HO\text{-}CH_2\text{-}CH_2\text{-}OH$
C) $HCHO + NH_2CONH_2$
D) $HOOC(CH_2)_4COOH + NH_2(CH_2)_6NH_2$

120) Select the correct match from the following options.

A) Melamine: cross- linked; PVC: linear; glycogen: branched chain polymer
B) PVC: cross- linked; melamine: linear; glycogen: branched chain polymer
C) Glycogen: cross- linked; PVC: linear; melamine: branched chain polymer
D) Glycogen: cross- linked; melamine: linear; PVC: branched chain polymer

Section 3 – Mathematics

121) If (-4,5) is the image of the point (6,1) with respect to the line L, then L is given by

A) 5x+2y=1
B) 5x-2y=0
C) 5x-2y+1=0
D) 2x-5y+1=0

---

122) Evaluate integral of $x^2/(x^2 + (9-x)^2)$ with limits from 4 to 5. The result is

A) 1/2
B) 0
C) 1
D) 2

---

123) The values of x for which $4^x + 4^{1-x} - 5 < 0$, is given by

A) x=1
B) x=0,1
C) x=0
D) 0<x<1

---

124) Derivative of $\cos^{-1}(2x^2-1)$ with respect to $\sqrt{1+2x}$ at x=1/2 is

A) 4/3
B) √6/5
C) √6/3
D) - 4√6/3

---

125) If x is one of the first fifty numbers chosen at random, then the probability that x+3/x is greater than 20 is

A) 11/50
B) 21/50
C) 31/50
D) 41/50

---

126) Which of the following is TRUE about the function $f(x) = x^4 - 4x^2$?

A) It has two local minima and one local maxima
B) It has two local minima and zero local maxima
C) It has one local minima and one local maxima
D) It has two local minima and two local maxima

---

127) Which of the following is the range of the function $3(\sin^{-1}x)^2 + 2(\cos^{-1}x)^2 + 7$?

A) $(3\pi^2 + 70)/10$ to $(11\pi^2 + 28)/4$
B) $(3\pi^2 + 70)/10$ to $(7\pi^2 + 28)/4$
C) $(3\pi^2 + 70)/10$ to $(3\pi^2 + 28)/4$
D) $(11\pi^2 + 70)/10$ to $(11\pi^2 + 28)/4$

128) A function f(x) is differentiable for all $x \in [1,2]$ such that $|f'(x)| < 2$. Which of the following options can be true?

A) f(1) = 9 , f(2) = 13
B) f(1) = 4 , f(2) = 6
C) f(1) = -3 , f(2) = -2
D) f(1) = -7 , f(2) = -10

---

129) Suppose P, Q and R are three sets, each with three elements. The number of subsets of the set P x Q x R, that have at least 2 elements is

A) 134217700
B) 134217701
C) 134217727
D) 134217728

---

130) z is a complex number such that arg(z) < 0. What will be the value of arg(-z) – arg(z)?

A) π/2
B) π
C) 0
D) π/4

---

131) There is a set P of ordered pairs in which each pair has a vowel as first element and a consonant as second element. It is given that $R = 2^{20}$. How many elements will be there in power set of P?

A) $16(R^4)$
B) $32(R^4)$
C) $16(R^5)$
D) $32(R^5)$

---

132) You are given a curve, y = ln (x + e). What will be the area enclosed between this curve and the coordinate axes?

A) 1
B) 0
C) 2e
D) e-1

---

133) The mapping f: N→N given by $f(n) = n^3+3$, nεN where N is the set of natural number, is

A) One to one and onto
B) One to one but not onto
C) Onto but not one to one
D) Neither one to one nor onto

134) A cubic equation $x^3 + rx - p = 0$ has roots a, b and c. A square matrix $M = [m_{ij}]$, i,j = 0,1 and 2, of size 3 X 3 is made such that $m_{00} = a$, $m_{11} = b$ and $m_{22} = c$. All other elements of M are 1. What should be the least value of p so that |M| is an odd prime?

A) 0
B) 1
C) -1
D) -2

135) Which term of the sequence {9-8i, 8-6i, 7-4i, ...} is a real number?

A) 4^{th} term
B) 5^{th} term
C) 6^{th} term
D) 7^{th} term

136) If $y = \tan^{-1}\left(\frac{x-a}{1+xa}\right)$ then $\frac{dy}{dx} =$

A) $\frac{1}{\sqrt{1+x^2}}$
B) $\frac{1}{1+x^2}$
C) $\frac{1}{\sqrt{1-x^2}}$
D) $\frac{1}{1-x^2}$

137) A person goes 2 km east, then 3 km north, then 4 km west and then 1 km north, starting from the origin. This point is taken as vector A. The vector B such that 3A + 5B = (9, 32), is

A) (4,3)
B) (-3,4)
C) (-4,3)
D) (3,4)

138) Which of the following functions is inverse of itself?

A) $f(t)=(1-t)/(1+t)$
B) $f(t)=(1-t^2)/(1+t^2)$
C) $f(t)= 4^{\log t}$
D) $f(t)=2^t$

139) The number of all positive odd divisors of 17500 is

A) 5
B) 8
C) 9
D) 10

140) A is a 3x3 matrix where its first row is (1 0 0), second row is (2 1 0) and third row is (3 2 1). P, Q and R are column matrices such that $AP = (1\ 0\ 0)^T$, $AQ = (2\ 3\ 0)^T$ and $AR = (0\ 0\ 1)^T$. If P, Q and R are three columns of matrix U, then |U| =

A) 0
B) 1
C) 3
D) 9

141) If $\cot(\sin^{-1}x)=\cos(\tan^{-1}\sqrt{3})$, then x=

A) 0
B) $\frac{2}{\sqrt{3}}$
C) 2
D) $\frac{2}{\sqrt{5}}$

142) If n(P)=8, n(Q)=10 and n(R)=5 ('n' denotes cardinality) for three disjoint sets P, Q, R then n(PUQUR)=

A) 23
B) 20
C) 18
D) 15

143) The sum value of the series $\frac{3}{4}+\frac{5}{36}+\frac{7}{144}+\frac{9}{400}+\ldots\ldots\ldots\infty$ is

A) 1
B) 2
C) 32
D) 0

144) Which of the following number cannot be in the range of $f(x) = 4\ \text{cosec}^4x - 7 + 3\ \sec^2x + 11$?

A) 11
B) 96
C) 101.5
D) 43

145) If 60 times the 60^{th} term of an AP with non zero common difference is equal to 40 times the 40^{th} term, then the 100^{th} term of this AP is

A) 0
B) 1
C) -1
D) 2

146) The domain of the function $f(x) = \frac{\log(x+5)}{x^2+4x+3}$ is

A) $(-\infty, -1)$
B) [-3, -1]
C) R- [-3, -1]
D) $(-5, \infty)$ - {-3, -1}

147) What will be the distance of (1, 0, 2) from the point of intersection of plane x-y+z=16 and the line (x-2)/3 = (y+1)/4 = (z-2)/12?

A) 13 units
B) 17 units
C) 25 units
D) 19 units

148) In a system of linear equations, three equations are given as

5x + 4y + 2z = 13; 4x - y - kz = 6; 2x + 3y + 3z = 16.

What should be the value of k so that the equations have no solution?

A) 3
B) 5
C) -3
D) -5

149) One of the roots of the equation $2x^3 - 9x^2 + kx - 13 = 0$ is 2 + 3i. What will be the real root of the equation?

A) 1
B) 1/4
C) -1/2
D) 1/2

150) The equation of a circle is C: $x^2 + y^2 - 6x - 4y + 11 = 0$. A point P(4,3), that lies on this circle is taken. A diameter with P as an end is drawn. What will be the coordinates of its other end?

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

151) What should be the positive value of p so that the magnitude of (3 + pi) where $i=\sqrt{(-1)}$ is twice that of (3/4) + pi?

A) 1
B) 0
C) 3/2
D) 3

152) For 'c' is the arbitrary constant, the solution of the differential equation $(x^2+2y^2)\,dx - xy\,dy = 0$ is

A) $x^2+y^2=x^4c^2$
B) $x^2-y^2=x^2c^2$
C) $x+y=x^4c^2$
D) $x^2+y^2=c^2$

153) sin(ix) =

A) i sinhx
B) i sin x
C) sin x
D) sinhx

154) Natural numbers from 51 to 150 are written on 100 cards. A card is drawn randomly from this set of 100 cards. What is the probability that the number written on the card drawn will either be a perfect square or a perfect cube?

A) 1/25
B) 3/50
C) 2/25
D) 1/20

155) Between 1 and 2, how many local maxima the function $f(x) = 6x^5 - 7x^4 + 3x^3 + 2x^2 + 11x - 17$ has?

A) 0
B) 1
C) 2
D) 3

156) It is given that P = Sum of all integral powers of (4/5) from 1 to n. Also, Q = 1 – P. The smallest natural number for which Q>P is

A) 3
B) 7
C) 9
D) Never possible

157) Let P and Q are two matrices such that PQ=Q and QP=P, then P^2+Q^2 =

A) P
B) Q
C) P+Q
D) P-Q

158) The equation xy=0 in 3D space represents

A) a pair of straight lines
B) a plane
C) a pair of planes at right angles
D) a pair of parallel planes

159) In a triangle PQR, A, B and C are the angles opposite to the corresponding sides of lengths a, b and c respectively. If the sides are a=5, b=13 and c=12 then sin B/2 + cos B/2 =

A) 1/2
B) $1/\sqrt{2}$
C) $\sqrt{2}$
D) 1

160) The minimum value of the function $Z=2x - y$ subjected to the constraints, $x+y \leq 5$, $x+2y \geq 8$, $x \geq 0$, $y \geq 0$ is

A) Z = 5
B) Z = 1
C) Z = -4
D) Z = -5

161) If $\alpha+\beta = \pi/2$ & $\beta+\gamma = \alpha$, then sin γ =

A) cos 2β
B) 1
C) sin 2β
D) tan 2β

162) P speaks truth in 70% cases and Q speaks in 80% of the cases. In what percentage of cases are they likely to contradict each other in stating the same fact?

A) 25%
B) 38%
C) 42%
D) 48%

163) If $3^x+3^y=3^{x+y}$, then at x=y=1, dy/dx =

A) 1
B) -1
C) 0
D) 2

164) The co-efficient of x^7 in the expansion of $(1+2x+3x^2+.....)^{5/2}$ is

A) 250
B) 280
C) 300
D) 330

165) It is given that $f(x) = e^x$, when $0 \leq x \leq 1$ and $f(x) = 2 - e^{(x-1)}$, when $1<x\leq2$. If g(x) = integral of f(x) from 0 to x, then the point where g(x) has local maxima is

A) 0
B) 1
C) 2
D) NOT determinable

166) For 'c' is the arbitrary constant, the solution of the differential equation $(x^2 - yx^2)\frac{dy}{dx} + (y^2 + xy^2) = 0$ is

A) log(xy)+ (1/x+1/y)=c
B) log(xy)+ (1/x-1/y)=c
C) log(x/y)- (1/x+1/y)=c
D) log(x/y)+ (1/x-1/y)=c

167) Three points M, N and P are taken on a cartesian plane such that the triangle formed by them lies completely inside the circle $x^2 + y^2 - 4x - 5 = 0$. What could the coordinates of the points M, N and P?

A) M(0,0) , N(0,2) , P(0, -3)
B) M(4,0) , N(0,2) , P(0, -3)
C) M(4,0) , N(0,2) , P(0, 0)
D) M(0, 0) , N(4,0) , P(0, -3)

168) A line through P(3,5) is such that its intercept between the axes bisected at P. Its equation is

A) 5x+3y=30
B) 3x+5y=30
C) x+5y=30
D) 5x+y=30

169) A differential equation $dy/dx = (y + 4x - 4)^2$ is given. At x = 0, y = 4 the solution of this differential equation is given by

A) y + 4x = 2tan (2x)
B) y + 4x - 4 = 2tan (x)
C) y + 4x - 4 = 2tan (2x)
D) y + 4x - 4 = tan (2x)

170) If $\sin^{-1}x\cos^{-1}x = p$,
then the value of $(\sin^{-1}x)^3 + (\cos^{-1}x)^3$ is

A) $(\pi/2)(\pi/4 - 3p)$
B) $(\pi/4)(\pi^2/4 - 3p)$
C) $(\pi/2)(\pi^2/4 - 3p)$
D) $(\pi/4)(\pi^2/2 - 3p)$

171) In which of these cases, the parabola generated by the given pair of directrix and focus will be a degenerate case?

A) Directrix: 2x + 4y -7 = 0, Focus: (3, 5)
B) Directrix: 7x - 3y - 2 =0, Focus: (2, 4)
C) Directrix: 8x - 3y + 21 = 0, Focus: (2, -4)
D) Directrix: x = 3; Focus: (6, 1)

172) Given a function $f(x) = x^4e^x$ where $x \neq 0$. Which of the given options is a correct expression for f "(x) ?

A) ((12/x) - x)f(x) + 2f'(x)
B) 8f(x) + 2f'(x)
C) $((12/x^2) - 1)f(x) + 2f'(x)$
D) 8f(x)/x + 3f'(x)

173) If P(A)=1/4, P(B)=1/5 and P(AB)=1/8 then $P(A^C/B^C)$ =

A) 21/32
B) 25/32
C) 27/32
D) 29/32

174) Here, [x] denotes the greatest integer less than or equal to x. Given that f(x) = [x] + x. The value obtained when this function is integrated with respect to x with lower limit as 3/2 and upper limit as 9/2, is

A) 12
B) 10.5
C) 8
D) 16.5

---

175) Evaluate the integral: $\int dy/[(y+6)\,(y+5)^{1/2}]$. The result is

A) $2\tan^{-1}(\sqrt{(y+6)})$ + constant
B) $2\tan^{-1}(y+6)$ + constant
C) $2\tan^{-1}(\sqrt{(y+5)})$ + constant
D) $2\tan^{-1}(y+5)$ + constant

---

176) The mean of three positive numbers is 9. The mean is larger than only one of these numbers. The mean deviation about mean is 2. The smallest number is

A) 5
B) 6
C) 7
D) 7.5

---

177) If α, β, γ are the angles made by a vector with the co-ordinate axes, then $\sin^2\alpha + \sin^2\beta + \sin^2\gamma$ =

A) 0
B) 1
C) -1
D) 2

---

178) A can solve 75% of the problems and B can solve 80% of the problems. If one problem is selected at random, the probability that the problem will be solved is

A) 0.95
B) 0.85
C) 0.72
D) 0.65

---

179) The value of 'x' for which the points (1,2,1), (0,1,3), (1,0,1) and (2,0,x) are coplanar is

A) x=0
B) x=1
C) x=-1
D) x=2

---

180) If a and b are unit vectors then the vector (a+b) X (aXb) is parallel to the vector

A) a+b
B) a
C) b
D) a-b

Space for Rough Work:

Space for Rough Work:

Space for Rough Work:

Space for Rough Work: