COMMON ENTRANCE TEST - 2010

DATE	SUBJECT	TIME
29-04-2010	PHYSICS	10.30 AM to 11.50 AM

MAXIMUM MARKS	TOTAL DURATION	MAXIMUM TIME FOR ANSWERING
60	80 MINUTES	70 MINUTES

MENTION YOUR CET NUMBER	QUESTION BOOKLET DETAILS	
	VERSION CODE	SERIAL NUMBER
	A - 1	595409

DOs :

1. Check whether the CET No. has been entered and shaded in the respective circles on the OMR answer sheet.
2. This Question Booklet is issued to you by the Invigilator after the **2nd Bell**, i.e., after **10.30 a.m.**
3. The Serial Number of this question booklet should be entered on the OMR answer sheet.
4. The Version Code of this question booklet should be entered on the OMR answer sheet and the respective circles should also be shaded completely.
5. Compulsorily sign at the bottom portion of the OMR answer sheet in the space provided.

DON'Ts :

1. **THE TIMING AND MARKS PRINTED ON THE OMR ANSWER SHEET SHOULD NOT BE DAMAGED/ MUTILATED / SPOILED.**
2. Until the **3rd Bell** is rung at **10.40 a.m.** :
   - Do not remove the seal/staple present on the right hand side of this question booklet.
   - Do not look inside this question booklet.
   - Do not start answering on the OMR answer sheet.

IMPORTANT INSTRUCTIONS TO CANDIDATES

1. This question booklet contains 60 questions and each question will have four different options / choices.
2. After the **3rd Bell** is rung at **10.40 a.m.**, remove the seal/staple present on the right hand side of this question booklet and start answering on the OMR answer sheet.
3. During the subsequent 70 minutes :
   - Read each question carefully.
   - Choose the correct answer from out of the four available options / choices given under each question.
   - **Completely darken/shade the relevant circle with a BLUE OR BLACK INK BALLPOINT PEN against the question number on the OMR answer sheet.**

CORRECT METHOD OF SHADING THE CIRCLE ON THE OMR SHEET IS AS SHOWN BELOW :

4. Please note that even a minute unintended ink dot on the OMR sheet will also be recognized and recorded by the scanner. Therefore, avoid multiple markings of any kind on the OMR answer sheet.
5. Use the space provided on each page of the question booklet for Rough Work. Do not use the OMR answer sheet for the same.
6. After the **last bell** is rung at **11.50 a.m.**, stop writing on the OMR answer sheet and affix your LEFT HAND THUMB IMPRESSION on the OMR answer sheet as per the instructions.
7. Hand over the OMR ANSWER SHEET to the room Invigilator as it is.
8. After separating and retaining the top sheet (KEA Copy), the Invigilator will return the bottom sheet replica (Candidate's copy) to you to carry home for self-evaluation.
9. Preserve the replica of the OMR answer sheet for a minimum period of ONE year.

PHYSICS

1. The dimensions of 'resistance' are same as those of ..... where h is the Planck's constant, e is the charge.

   1) $\frac{h}{e^2}$ 2) $\frac{h}{e}$ 3) $\frac{h^2}{e^2}$ 4) $\frac{h^2}{e}$

2. A train is moving slowly on a straight track with a constant speed of 2 ms^{-1}. A passenger in that train starts walking at a steady speed of 2 ms^{-1} to the back of the train in the opposite direction of the motion of the train. So to an observer standing on the platform directly in front of that passenger, the velocity of the passenger appears to be .....

   1) 2 ms^{-1} in the opposite direction of the train
   2) zero
   3) 4 ms^{-1}
   4) 2 ms^{-1}

3. A ball rests upon a flat piece of paper on a table top. The paper is pulled horizontally but quickly towards right as shown. Relative to its initial position with respect to the table, the ball .....

   a) remains stationary if there is no friction between the paper and the ball.

   b) moves to the left and starts rolling backwards, i.e. to the left if there is a friction between the paper and the ball.
   c) moves forward, i.e. in the direction in which the paper is pulled.

   Here, the correct statement/s is/are .....

   1) only a) 2) only b)
   3) both a) and b) 4) only c)

4. A boy throws a cricket ball from the boundary to the wicket-keeper. If the frictional force due to air cannot be ignored, the forces acting on the ball at the position X are represented by .....

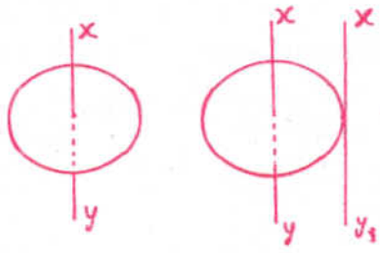
   1)  2)  3)  4) 

5. If the linear momentum of a body is increased by 50%, then the kinetic energy of that body increases by .....

   1) 225% 2) 25% 3) 100% 4) 125%

(Space for Rough Work)

6. The moment of inertia of a circular disc of radius 2 m and mass 1 kg about an axis passing through the centre of mass but perpendicular to the plane of the disc is 2 kgm^2. Its moment of inertia about an axis parallel to this axis but passing through the edge of the disc is ..... (See the given figure).



1) 10 kgm^2
2) 6 kgm^2
3) 8 kgm^2
4) 4 kgm^2

7. An astronaut on a strange planet finds that acceleration due to gravity is twice as that on the surface of Earth. Which of the following could explain this?
   1) Both the mass and radius of the planet are twice as that of Earth.
   2) Mass of the planet is half as that of Earth, but radius is same as that of Earth.
   3) Both the mass and radius of the planet are half as that of Earth.
   4) Radius of the planet is half as that of Earth, but the mass is the same as that of Earth.

8. Which of the following substances has the highest elasticity?
   1) Rubber
   2) Copper
   3) Sponge
   4) Steel

9. Three liquids of equal masses are taken in three identical cubical vessels A, B and C. Their densities are P_A, P_B and P_C respectively. But $P_A < P_B < P_C$. The force exerted by the liquid on the base of the cubical vessel is .....
   1) the same in all the vessels
   2) maximum in vessel A
   3) maximum in vessel C
   4) minimum in vessel C

10. Water is in streamline flow along a horizontal pipe with nonuniform cross-section. At a point in the pipe where the area of cross-section is 10 cm^2, the velocity of water is 1 ms^{-1} and the pressure is 2000 Pa. The pressure at another point where the cross-sectional area is 5 cm^2 is .....
   1) 1000 Pa
   2) 500 Pa
   3) 4000 Pa
   4) 2000 Pa

(Space for Rough Work)

11. The temperature of a gas contained in a closed vessel of constant volume increases by 1^0C when the pressure of the gas is increased by 1%. The initial temperature of the gas is .....

1) 100^0C
2) 200 K
3) 100 K
4) 273^0C

12. A motorboat covers a given distance in 6 hours moving downstream on a river. It covers the same distance in 10 hours moving upstream. The time it takes to cover the same distance in still water is .....

1) 6.5 hours
2) 8 hours
3) 9 hours
4) 7.5 hours

13. Two slabs are of the thicknesses d_1 and d_2. Their thermal conductivities are K_1 and K_2 respectively. They are in series. The free ends of the combination of these two slabs are kept at temperatures θ_1 and θ_2. Assume $\theta_1 > \theta_2$. The temperature θ of their common junction is .....

1) $\frac{K_1\theta_1 d_2 + K_2\theta_2 d_1}{K_1 d_2 + K_2 d_1}$
2) $\frac{K_1\theta_1 + K_2\theta_2}{K_1 + K_2}$
3) $\frac{K_1\theta_1 + K_2\theta_2}{\theta_1 + \theta_2}$
4) $\frac{K_1\theta_1 d_1 + K_2\theta_2 d_2}{K_1 d_2 + K_2 d_1}$

14. Hot water cools from 60^0C to 50^0C in the first 10 minutes and to 42^0C in the next 10 minutes. Then the temperature of the surroundings is .....

1) 15^0C
2) 10^0C
3) 20^0C
4) 30^0C

15. The efficiency of Carnot's heat engine is 0.5 when the temperature of the source is T_1 and that of sink is T_2. The efficiency of another Carnot's heat engine is also 0.5. The temperature of source and sink of the second engine are respectively .....

1) $T_1 + 5,\ T_2 - 5$
2) $T_1 + 10,\ T_2 - 10$
3) $2T_1,\ 2T_2$
4) $2T_1,\ \frac{T_2}{2}$

(Space for Rough Work)

16. Two simple harmonic motions are represented by $y_1 = 5\left[Sin\,2\pi t + \sqrt{3}\,Cos\,2\pi t\right]$ and $y_2 = 5Sin\left(2\pi t + \frac{\pi}{4}\right)$. The ratio of their amplitude is .....

1) 1 : 3
2) $\sqrt{3}$: 1
3) 1 : 1
4) 2 : 1

17. A bat flies at a steady speed of 4 ms^{-1} emitting a sound of $f = 90 \times 10^3$ Hz. It is flying horizontally towards a vertical wall. The frequency of the reflected sound as detected by the bat will be .....
(Take velocity of sound in air as 330 ms^{-1}).

1) 92.1×10^3 Hz
2) 89.1×10^3 Hz
3) 88.1×10^3 Hz
4) 87.1×10^3 Hz

18. A closed organ pipe and an open organ pipe of same length produce 2 beats/second while vibrating in their fundamental modes. The length of the open organ pipe is halved and that of closed pipe is doubled. Then, the number of beats produced per second while vibrating in the fundamental mode is .....

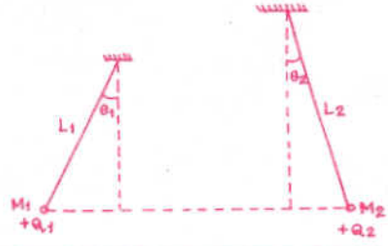
1) 8
2) 7
3) 2
4) 6

19. A uniform wire of length L, diameter D and density P is stretched under a tension T. The correct relation between its fundamental frequency 'f', the length L and the diameter D is .....

1) $f \alpha \frac{L}{D^2}$
2) $f \alpha \frac{1}{LD^2}$
3) $f \alpha \frac{1}{LD}$
4) $f \alpha \frac{1}{L\sqrt{D}}$

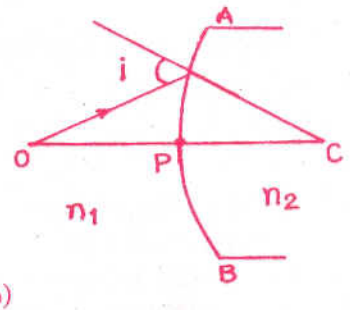
20. Two small spheres of masses M_1 and M_2 are suspended by weightless insulating threads of lengths L_1 and L_2. The spheres carry charges of Q_1 and Q_2 respectively. The spheres are suspended such that they are in level with one another and the threads are inclined to the vertical at angles of θ_1 and θ_2 as shown. Which one of the following conditions is essential, if $\theta_1 = \theta_2$?

1) $Q_1 = Q_2$
2) $L_1 = L_2$
3) $M_1 \neq M_2$, but $Q_1 = Q_2$
4) $M_1 = M_2$



(Space for Rough Work)

21. A point object O is kept at a distance of $OP = u$. The radius of curvature of the spherical surface APB is $CP = R$. The refractive index of the media are n_1 and n_2 which are as shown in the diagram. Then,



a) if $n_1 > n_2$, image is virtual for all values of 'u'.

b) if $n_2 = 2n_1$, image is virtual when $R > u$.

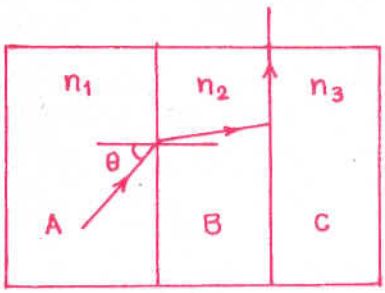
c) the image is real for all values of u, n_1 and n_2.

Here, the correct statement/s is/are .....

1) only a) 2) a), b) and c)

3) only b) 4) both a) and b)

22. A, B and C are the parallel sided transparent media of refractive index n_1, n_2 and n_3 respectively. They are arranged as shown in the figure. A ray is incident at an angle θ on the surface of separation of A and B which is as shown in the figure. After the refraction into the medium B, the ray grazes the surface of separation of the media B and C. Then, $Sin\ \theta$ = ...



1) $\frac{n_2}{n_3}$ 2) $\frac{n_1}{n_2}$

3) $\frac{n_3}{n_1}$ 4) $\frac{n_1}{n_3}$

23. A boat has green light of wavelength $\lambda = 500$ nm on the mast. What wavelength would be measured and what colour would be observed for this light as seen by a diver submerged in water by the side of the boat? Given $n_w = 4/3$.

1) Green of wavelength 500 nm 2) Blue of wavelength 376 nm

3) Green of wavelength 376 nm 4) Red of wavelength 665 nm

24. Two beams of red and violet colours are made to pass separately through a prism of $A = 60^0$. In the minimum deviation position, the angle of refraction inside the prism will be

1) greater for violet colour 2) 30^0 for both the colours

3) greater for red colour 4) equal but not 30^0 for both the colours

25. The focal length of a plano convex lens is 'f' and its refractive index is 1.5. It is kept over a plane glass plate with its curved surface touching the glass plate. The gap between the lens and the glass plate is filled by a liquid. As a result, the effective focal length of the combination becomes $2f$. Then the refractive index of the liquid is .....

1) 1.25 2) 1.33

3) 1.5 4) 2

(Space for Rough Work)

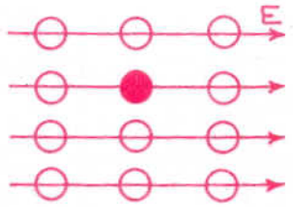
26. The wavelength of the light used in Young's double slit experiment is λ. The intensity at a point on the screen where the path difference is $\frac{\lambda}{6}$ is I. If I_0 denotes the maximum intensity, then the ratio of I and I_0 is .....

1) 0.707 2) 0.75
3) 0.866 4) 0.5

27. What is the minimum thickness of a thin film required for constructive interference in the reflected light from it?
Given, the refractive index of the film = 1.5, wavelength of the light incident on the film = 600 nm.

1) 50 nm 2) 200 nm
3) 100 nm 4) 300 nm

28. There is a uniform electric field of intensity E which is as shown. How many labelled points have the same electric potential as the fully shaded point?



1) 8 2) 11
3) 2 4) 3

29. Critical angle for certain medium is Sin^{-1} (0.6). The polarizing angle of that medium is .....

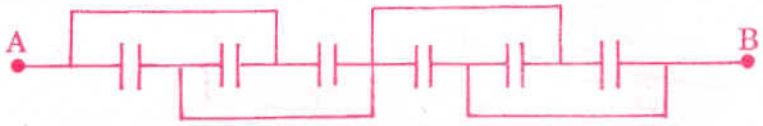
1) $Tan^{-1}(1.6667)$ 2) $Tan^{-1}[0.6667]$
3) $Tan^{-1}[1.5]$ 4) $Sin^{-1}[0.8]$

30. Electromagnetic wave consists of periodically oscillating electric and magnetic vectors .....

1) in randomly oriented planes but vibrating in phase.
2) in mutually perpendicular planes but vibrating in phase.
3) in mutually perpendicular planes but vibrating with a phase difference of π
4) in mutually perpendicular planes but vibrating with a phase difference of $\pi/2$

(Space for Rough Work)

31. All capacitors used in the diagram are identical and each is of capacitance C. Then the effective capacitance between the points A and B is .....



1) C 2) $3C$

3) $1.5C$ 4) $6C$

32. Two identical conducting balls A and B have positive charges q_1 and q_2 respectively. But $q_1 \neq q_2$. The balls are brought together so that they touch each other and then kept in their original positions. The force between them is .....

1) same as that before the balls touched
2) zero
3) less than that before the balls touched
4) greater than that before the balls touched

33. Red light of wavelength 625 nm is incident normally on an optical diffraction grating with 2×10^5 lines/m. Including central principal maxima, how many maxima may be observed on a screen which is far from the grating?

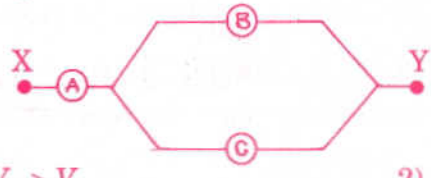
1) 8 2) 16

3) 15 4) 17

34. A battery of e.m.f. E has an internal resistance 'r'. A variable resistance R is connected to the terminals of the battery. A current I is drawn from the battery. V is the terminal P.D. If R alone is gradually reduced to zero, which of the following best describes I and V?

1) I approaches E/r, V approaches E
2) I approaches infinity, V approaches E
3) I approaches zero, V approaches E
4) I approaches E/r, V approaches zero

35. Three voltmeters A, B and C having resistances R, $1.5R$ and $3R$ respectively are used in a circuit as shown. When a P.D. is applied between X and Y, the reading of the voltmeters are V_1, V_2 and V_3 respectively. Then .....

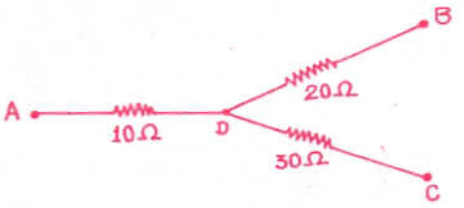


1) $V_1 > V_2 > V_3$ 2) $V_1 > V_2 = V_3$

3) $V_1 = V_2 = V_3$ 4) $V_1 < V_2 = V_3$

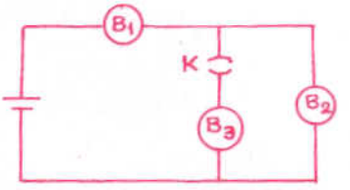
(Space for Rough Work)

36. In the circuit given here, the points A, B and C are 70 V, zero, 10 V respectively. Then



1) currents in the paths AD, DB and DC are in the ratio of 1 : 2 : 3.
2) currents in the paths AB, DB and DC are in the ratio of 3 : 2 : 1.
3) the point D will be at a potential of 60 V.
4) the point D will be at a potential of 20 V.

37. B_1, B_2 and B_3 are the three identical bulbs connected to a battery of steady e.m.f. with key K closed. What happens to the brightness of the bulbs B_1 and B_2 when the key is opened?



1) Brightness of the bulb, B_1 decreases and that of B_2 increases.
2) Brightness of the bulbs B_1 and B_2 decreases.
3) Brightness of the bulbs B_1 increases and that of B_2 decreases.
4) Brightness of the bulbs B_1 and B_2 increases.

38. Magnetic field at the centre of a circular coil of radius R due to current I flowing through it is B. The magnetic field at a point along the axis at distance R from the centre is .....

1) $\frac{B}{\sqrt{8}}$ 2) $\sqrt{8}B$ 3) $\frac{B}{2}$ 4) $\frac{B}{4}$

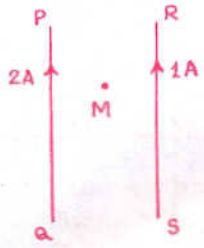
39. Two thick wires and two thin wires, all of same material and same length, form a square in three different ways P, Q and R as shown in the figure. With correct connections shown, the magnetic field due to the current flow, at the centre of the loop will be zero in case of .....

1) P and Q only
2) P and R only
3) Q and R only
4) P only

40. There is a uniform magnetic field directed perpendicular and into the plane of the paper. An irregular shaped conducting loop is slowly changing into a circular loop in the plane of the paper. Then .....

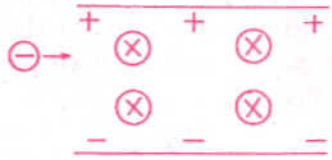
1) AC is induced in the loop.
2) no current is induced in the loop.
3) current is induced in the loop in the anti-clockwise direction.
4) current is induced in the loop in the clockwise direction.

41. PQ and RS are long parallel conductors separated by certain distance. M is the midpoint between them (see the figure). The net magnetic field at M is B. Now, the current 2A is switched off. The field at M now becomes .....



1) $\frac{B}{2}$
2) $3B$
3) $2B$
4) B

42. An electron enters the space between the plates of a charged capacitor as shown. The charge density on the plate is σ. Electric intensity in the space between the plates is E. A uniform magnetic field B also exists in that space perpendicular to the direction of E. The electron moves perpendicular to both $\vec{E}$ and $\vec{B}$ without any change in direction.



The time taken by the electron to travel a distance l in that space is .....

1) $\frac{\epsilon_0 lB}{\sigma}$
2) $\frac{\epsilon_0 l}{\sigma B}$
3) $\frac{\sigma l}{\epsilon_0 B}$
4) $\frac{\sigma B}{\epsilon_0 l}$

43. In a series resonant R–L–C circuit, the voltage across R is 100 V and the value of $R = 1000\ \Omega$. The capacitance of the capacitor is 2×10^{-6} F; angular frequency of AC is 200 rad s^{-1}. Then the P.D. across the inductance coil is .....

1) 250 V
2) 400 V
3) 100 V
4) 40 V

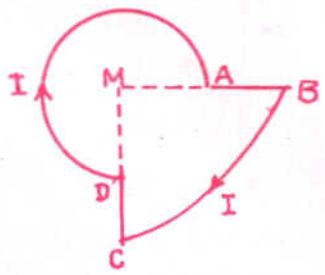
44. A capacitor and an inductance coil are connected in separate AC circuits with a bulb glowing in both the circuits. The bulb glows more brightly when .....

1) separation between the plates of the capacitor is increased.
2) a dielectric is introduced into the gap between the plates of the capacitor.
3) an iron rod is introduced into the inductance coil.
4) the number of turns in the inductance coil is increased.

45. A horizontal metal wire is carrying an electric current from the north to the south. Using a uniform magnetic field, it is to be prevented from falling under gravity. The direction of this magnetic field should be towards the .....

1) east
2) west
3) north
4) south

46. A current I is flowing through the loop. The direction of the current and the shape of the loop are as shown in the figure. The magnetic field at the centre of the loop is $\frac{\mu_0 I}{R}$ times ..... ($MA = R$, $MB = 2R$, $\angle DMA = 90^0$)



1) $\frac{7}{16}$, but out of the plane of the paper.

2) $\frac{7}{16}$, but into the plane of the paper.

3) $\frac{5}{16}$, but out of the plane of the paper.

4) $\frac{5}{16}$, but into the plane of the paper.

47. An ideal choke draws a current of 8A when connected to an AC supply of 100 V, 50 Hz. A pure resistor draws a current of 10 A when connected to the same source. The ideal choke and the resistor are connected in series and then connected to the AC source of 150 V, 40 Hz. The current in the circuit becomes .....

1) 18A
2) 10A
3) $\frac{15}{\sqrt{2}}$A
4) 8A

48. The spectrum of an oil flame is an example for .....

1) line absorption spectrum
2) band emission spectrum
3) line emission spectrum
4) continuous emission spectrum

49. According to Einstein's photoelectric equation, the graph of K.E. of the photoelectron emitted from the metal versus the frequency of the incident radiation gives a straight line graph, whose slope .....

1) is same for all metals and independent of the intensity of the incident radiation.
2) depends on the nature of the metal.
3) depends on the intensity of the incident radiation.
4) depends on the nature of the metal and also on the intensity of incident radiation.

50. An electron is moving in an orbit of a hydrogen atom from which there can be a maximum of six transitions. An electron is moving in an orbit of another hydrogen atom from which there can be a maximum of three transitions. The ratio of the velocity of the electron in these two orbits is .....

1) $\frac{5}{4}$
2) $\frac{3}{4}$
3) $\frac{1}{2}$
4) $\frac{2}{1}$

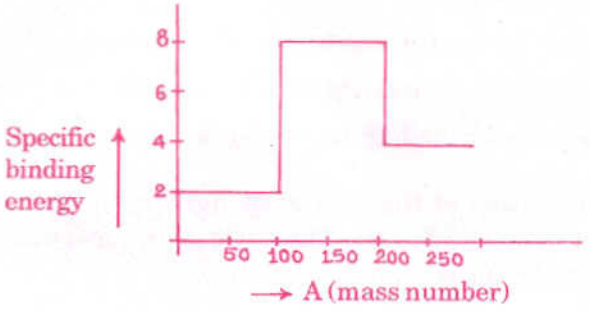
(Space for Rough Work)

51. υ_1 is the frequency of the series limit of Lyman series, υ_2 is the frequency of the first line of Lyman series and υ_3 is the frequency of the series limit of the Balmer series. Then .....

1) $\frac{1}{\upsilon_2} = \frac{1}{\upsilon_1} + \frac{1}{\upsilon_3}$ 2) $\frac{1}{\upsilon_1} = \frac{1}{\upsilon_2} + \frac{1}{\upsilon_3}$

3) $\upsilon_1 - \upsilon_2 = \upsilon_3$ 4) $\upsilon_1 = \upsilon_2 - \upsilon_3$

52. Assume the graph of specific binding energy versus mass number is as shown in the figure. Using this graph, select the correct choice from the following :



1) Fusion of two nuclei of mass number lying in the range of $1 < A < 50$ will release energy.
2) Fission of the nucleus of mass number lying in the range of $100 < A < 200$ will release energy when broken into two fragments.
3) Fusion of two nuclei of mass number lying in the range of $100 < A < 200$ will release energy.
4) Fusion of two nuclei of mass number lying in the range of $51 < A < 100$ will release energy.

53. Pick out the correct statement from the following :

1) Pu^{239} is not suitable for a fission reaction.
2) For stable nucleus, the specific binding energy is low.
3) Energy released per unit mass of the reactant is less in case of fusion reaction.
4) Packing fraction may be positive or may be negative

54. A radioactive sample S_1 having the activity A_1 has twice the number of nuclei as another sample S_2 of activity A_2. If $A_2 = 2A_1$, then the ratio of half life of S_1 to the half life of S_2 is

1) 0.25 2) 0.75 3) 4 4) 2

55. When a neutron is disintegrated to give a β-particle, ...

1) a proton alone is emitted.
2) a proton and an antineutrino are emitted.
3) a neutrino alone is emitted.
4) a proton and neutrino are emitted.

56. The forbidden energy gap in *Ge* is 0.72 eV. Given, $hc = 12400\ eV - \overset{0}{A}$. The maximum wavelength of radiation that will generate an electron hole pair is .....

1) $17222\overset{0}{A}$ 2) $1722\overset{0}{A}$

3) $172220\overset{0}{A}$ 4) $172.2\overset{0}{A}$

57. Pick out the statement which is NOT correct.

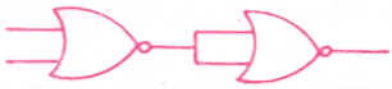
1) Width of the depletion region increases as the forward bias voltage increases in case of a N–P junction diode.
2) In a forward bias condition, the diode heavily conducts.
3) At a low temperature, the resistance of a semiconductor is very high.
4) Movement of holes is restricted to the valence band only.

58. In a given direction, the intensities of the scattered light by a scattering substance for two beams of light are in the ratio of 256 : 81. The ratio of the frequency of the first beam to the frequency of the second beam is .....

1) 64 : 27 2) 2 : 1

3) 64 : 127 4) 1 : 2

59. Identify the logic operation performed by the circuit given here.



1) NOT 2) NAND

3) OR 4) NOR

60. The de-Broglie wavelength of the electron in the ground state of the hydrogen atom is ..... (radius of the first orbit of hydrogen atom = 0.53 A).

1) $1.06\overset{0}{A}$ 2) $0.53\overset{0}{A}$

3) $1.67\overset{0}{A}$ 4) $3.33\overset{0}{A}$

(Space for Rough Work)

COMMON ENTRANCE TEST - 2010

DATE	SUBJECT	TIME
29-04-2010	CHEMISTRY	02.30 PM to 03.50 PM

MAXIMUM MARKS	TOTAL DURATION	MAXIMUM TIME FOR ANSWERING
60	80 MINUTES	70 MINUTES

MENTION YOUR CET NUMBER					QUESTION BOOKLET DETAILS	
					VERSION CODE	SERIAL NUMBER
					A - 1	715377

DOs :

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CHEMISTRY

1. In the electrolytic refining of Zinc, ...
   1) the impure metal is at the cathode.
   2) graphite is at the anode.
   3) acidified zinc sulphate is the electrolyte.
   4) the metal ion gets reduced at the anode.

2. The wave number of the spectral line in the emission spectrum of hydrogen will be equal to $\frac{8}{9}$ times the Rydberg's constant if the electron jumps from .....
   1) $n = 10$ to $n = 1$
   2) $n = 3$ to $n = 1$
   3) $n = 2$ to $n = 1$
   4) $n = 9$ to $n = 1$

3. Consider the following gaseous equilibria with equilibrium constants K_1 and K_2 respectively.

   $SO_{2(g)} + \frac{1}{2}O_{2(g)} \rightleftharpoons SO_{3(g)}$

   $2SO_{3(g)} \rightleftharpoons 2SO_{2(g)} + O_{2(g)}$

   The equilibrium constants are related as .....
   1) $2K_1 = K_2^2$
   2) $K_1^2 = \frac{1}{K_2}$
   3) $K_2^2 = \frac{1}{K_1}$
   4) $K_2 = \frac{2}{K_1^2}$

4. Enthalpy of vapourization of benzene is +35.3 kJ mol^{-1} at its boiling point of 80^0C. The entropy change in the transition of the vapour to liquid at its boiling point [in JK^{-1} mol^{-1}] is .....
   1) –100
   2) –441
   3) +100
   4) +441

5. Which one of the following conversions involve change in both hybridization and shape?
   1) $NH_3 \longrightarrow NH_4^+$
   2) $CH_4 \longrightarrow C_2H_6$
   3) $H_2O \longrightarrow H_3O^+$
   4) $BF_3 \longrightarrow BF_4^-$

(Space for Rough Work)

6. In chromite ore, the oxidation number of iron and chromium are respectively .....

1) +3, +6 2) +3, +2

3) +2, +3 4) +2, +6

7. For the reversible reaction

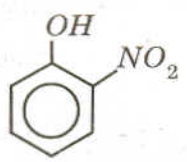
$A_{(s)} + B_{(g)} \rightleftharpoons C_{(g)} + D_{(g)} : \Delta G^0 = -350\,kJ.$

Which one of the following statements is true?

1) Equilibrium constant is greater than one.
2) The entropy change is negative.
3) The reaction is thermodynamically not feasible.
4) The reaction should be instantaneous.

8. Out of the below two compounds, the vapour pressure of (B) at a particular temperature is .....

(A)



(B)

1) lower than that of (A)
2) higher than that of (A)
3) same as that of (A)
4) higher or lower than (A), depending on the size of the vessel.

9. The amount of heat evolved when 500 cm^3 of 0.1 M *HCl* is mixed with 200 cm^3 of 0.2 M *NaOH* is .....

1) 1.292 kJ 2) 2.292 kJ

3) 3.392 kJ 4) 0.292 kJ

10. During the adsorption of krypton on activated charcoal at low temperature, ...

1) $\Delta H < 0$ and $\Delta S < 0$ 2) $\Delta H > 0$ and $\Delta S < 0$

3) $\Delta H < 0$ and $\Delta S > 0$ 4) $\Delta H > 0$ and $\Delta S > 0$

(Space for Rough Work)

11. The set of quantum numbers for the outermost electron for copper in its ground state is .....

1) 3, 2, 2, +½ 2) 4, 1, 1, +½

3) 4, 2, 2, +½ 4) 4, 0, 0, +½

12. Peroxide ion .....

a) is diamagnetic.

b) has five completely filled antibonding molecular orbitals.

c) is isoelectronic with neon.

d) has bond order one.

Which one of these is correct?

1) a), b) and d) 2) d) and c)

3) a) and d) 4) a), b) and c)

13. Which one of these is NOT true for benzene?

1) There are three carbon-carbon single bonds and three carbon-carbon double bonds.

2) It forms only one type of monosubstituted product.

3) The bond angle between the carbon-carbon bonds is 120^0.

4) The heat of hydrogenation of benzene is less than the theoretical value.

14. A mixture of $CaCl_2$ and $NaCl$ weighing 4.44 g is treated with sodium carbonate solution to precipitate all the Ca^{+2} ions as calcium carbonate. The calcium carbonate so obtained is heated strongly to get 0.56 g of CaO. The percentage of $NaCl$ in the mixture (atomic mass of Ca = 40) is .....

1) 30.6 2) 75

3) 69.4 4) 25

15. For one mole of an ideal gas, increasing the temperature from 10^0C to 20^0C .....

1) increases the rms velocity by $\sqrt{2}$ times.

2) increases the average kinetic energy by two times.

3) increases both the average kinetic energy and rms velocity, but not significantly.

4) increases the rms velocity by two times.

(Space for Rough Work)

16. Generally, the first ionization energy increases along a period. But there are some exceptions. One which is NOT an exception is .....

1) *Na* and *Mg* 2) *N* and *O*

3) *Be* and *B* 4) *Mg* and *Al*

17. 50 cm^3 of 0.2 N *HCl* is titrated against 0.1 N *NaOH* solution. The titration is discontinued after adding 50 cm^3 of *NaOH*. The remaining titration is completed by adding 0.5 N *KOH*. The volume of *KOH* required for completing the titration is .....

1) 10 cm^3 2) 12 cm^3

3) 10.5 cm^3 4) 25 cm^3

18. In which one of the following, does the given amount of chlorine exert the least pressure in a vessel of capacity 1 dm^3 at 273K?

1) 0.071 g 2) 0.0355 g

3) 0.02 mole 4) 6.023×10^{21} molecules

19. Based on the first law of thermodynamics, which one of the following is correct?

1) For an adiabatic process : $\Delta U = -w$
2) For an isochoric process : $\Delta U = -q$
3) For a cyclic process : $q = -w$
4) For an isothermal process : $q = +w$

20. For alkali metals, which one of the following trends is INCORRECT?

1) Ionization energy : $Li > Na > K > Rb$
2) Hydration energy : $Li > Na > K > Rb$
3) Atomic size : $Li < Na < K < Rb$
4) Density : $Li < Na < K < Rb$

(Space for Rough Work)

21. One gram of silver gets distributed between 10 cm^3 of molten zinc and 100 cm^3 of molten lead at 800^0C. The percentage of silver in the zinc layer is approximately .....

1) 91 2) 89
3) 94 4) 97

22. One mole of an organic compound '*A*' with the formula C_3H_8O reacts completely with two moles of *HI* to form *X* and *Y*. When '*Y*' is boiled with aqueous alkali forms *Z*. *Z* answers the iodoform test. The compound '*A*' is .....

1) Propan–1–ol 2) Propan–2–ol
3) methoxyethane 4) ethoxyethane

23. The IUPAC name of $K_2\left[Ni\ (CN)_4\right]$ is .....

1) Potassium tetracyanatonickelate (II)
2) Potassium tetracyanonickelate (II)
3) Potassium tetracyanonickel (III)
4) Potassium tetracyanatonickel (II)

24. The spin only magnetic moment of Mn^{+4} ion is nearly .....

1) 6 BM 2) 3 BM
3) 5 BM 4) 4 BM

25. In Kjeldahl's method, ammonia from 5 g of food neutralizes 30 cm^3 of 0.1 N acid. The percentage of nitrogen in the food is .....

1) 8.4 2) 0.84
3) 1.68 4) 16.8

(Space for Rough Work)

26. Carbon can reduce ferric oxide to iron at a temperature above 983 K because .....

1) carbon has a higher affinity towards oxidation than iron.
2) carbon monoxide formed is thermodynamically less stable than ferric oxide.
3) iron has a higher affinity towards oxygen than carbon.
4) free energy change for the formation of carbon dioxide is less negative than that for ferric oxide.

27. An oxygen containing organic compound upon oxidation forms a carboxylic acid as the only organic product with its molecular mass higher by 14 units. The organic compound is .....

1) a primary alcohol
2) an aldehyde
3) a ketone
4) a secondary alcohol

28. The compound obtained when acetaldehyde reacts with dilute aqueous sodium hydroxide exhibits .....

1) optical isomerism
2) geometric isomerism
3) both optical and geometric isomerism
4) neither optical nor geometric isomerism

29. The activation energy for a reaction at the temperature TK was found to be 2.303 RT J mol^{-1}. The ratio of the rate constant to Arrhenius factor is .....

1) 10^{-2}
2) 10^{-1}
3) 2×10^{-2}
4) 2×10^{-3}

30. A dibromo derivative of an alkane reacts with sodium metal to form an alicyclic hydrocarbon. The derivative is .....

1) 2, 2–dibromobutane
2) 1, 1–dibromopropane
3) 1, 4–dibromobutane
4) 1, 2–dibromoethane

(Space for Rough Work)

31. Time required for 100 percent completion of a zero order reaction is .....

1) $\frac{a}{2k}$ 2) $\frac{2k}{a}$

3) $a\,k$ 4) $\frac{a}{k}$

32. 0.023 g of sodium metal is reacted with 100 cm^3 of water. The pH of the resulting solution is .....

1) 11 2) 10

3) 12 4) 9

33. Which one of the following is wrongly matched?

1) $\left[Ni(CO)_4\right]$ – neutral ligand 2) $\left[Cu(NH_3)_4\right]^{+2}$ – square planar

3) $\left[Co(en)_3\right]^{+3}$ – follows EAN rule 4) $\left[Fe(CN)_6\right]^{-3}$ – sp^3d^2

34. Which one of the following conformations of cyclohexane is the least stable?

1) Boat 2) Half-chair

3) Chair 4) Twisted-boat

35. Which one of the following is a molecular crystal?

1) Quartz 2) Rock salt

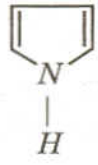
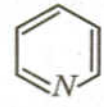
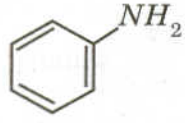
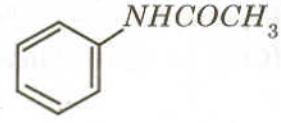
3) Diamond 4) Dry ice

(Space for Rough Work)

36. A buffer solution contains 0.1 mole of sodium acetate dissolved in 1000 cm^3 of 0.1 M acetic acid. To the above buffer solution, 0.1 mole of sodium acetate is further added and dissolved. The pH of the resulting buffer is equal to .....

1) pK_a
2) $pK_a - Log\,2$
3) $pK_a + Log\,2$
4) $pK_a + 2$

37. Which one of the following has the most nucleophilic nitrogen?

1) 
2) 
3) 
4) 

38. Chloroacetic acid is a stronger acid than acetic acid. This can be explained using .....

1) –I effect
2) –M effect
3) +I effect
4) +M effect

39. The correct sequence of reactions to convert p-nitrophenol into quinol involves .....

1) hydrolysis, diazotization and reduction
2) reduction, diazotization and hydrolysis
3) diazotization, reduction and hydrolysis
4) hydrolysis, reduction and diazotization

40. $CH_3CH_2Br \xrightarrow[\Delta]{Aq\ KOH} A \xrightarrow[\Delta]{KMnO_4/H^+} B \xrightarrow[\Delta]{NH_3} C \xrightarrow[\text{alkali}]{Br_2} D$; "D" is .....

1) CH_3CONH_2
2) CH_3Br
3) $CHBr_3$
4) CH_3NH_2

(Space for Rough Work)

41. The letter 'D' in D–glucose signifies .....
    1) dextrorotatory
    2) configuration at all chiral carbons
    3) configuration at a particular chiral carbon
    4) that it is a monosaccharide

42. Reaction of methyl bromide with aqueous sodium hydroxide involves .....
    1) S_N1 mechanism
    2) racemisation
    3) S_N2 mechanism
    4) inversion of configuration

43. 9.65 C of electric current is passed through fused anhydrous magnesium chloride. The magnesium metal thus obtained is completely converted into a Grignard reagent. The number of moles of the Grignard reagent obtained is .....
    1) 1×10^{-4}
    2) 5×10^{-4}
    3) 1×10^{-5}
    4) 5×10^{-5}

44. Which one of the following does NOT involve coagulation?
    1) Peptization
    2) Formation of delta regions
    3) Clotting of blood by the use of ferric chloride
    4) Treatment of drinking water by potash alum

45. In alkaline medium, alanine exists predominantly as/in .....
    1) zwitterion
    2) anion
    3) covalent form
    4) cation

(Space for Rough Work)

46. The standard emf of a galvanic cell involving 3 moles of electrons in its redox reaction is 0.59 V. The equilibrium constant for the reaction of the cell is .....

1) 10^{20} 2) 10^{25}

3) 10^{30} 4) 10^{15}

47. Benzaldehyde and acetone can be best distinguished using .....

1) sodium hydroxide solution 2) Fehling's solution

3) Tollens' reagent 4) 2, 4-DNPH

48. Which one of the following statements is true?

1) Drying of oil involves hydrolysis
2) Saponification of oil yields a diol.
3) Refining of oil involves hydrogenation
4) Addition of antioxidant to oil minimizes rancidity

49. The following data is obtained during the first order thermal decomposition of $2A_{(g)} \longrightarrow B_{(g)} + C_{(s)}$, at constant volume and temperature.

Sr. No.	Time	Total pressure in Pascal
1.	At the end of 10 minutes	300
2.	After completion	200

The rate constant in min^{-1} is .....

1) 6.93 2) 0.0693

3) 69.3 4) 0.00693

50. Phenol $\xrightarrow{X}$ forms a tribromo derivative. "X" is .....

1) bromine in water
2) bromine in benzene
3) bromine in carbon tetrachloride at 0^0C.
4) potassium bromide solution

(Space for Rough Work)

51. The correct sequence of steps involved in the mechanism of Cannizzaro's reaction is .....

1) transfer of H^-, transfer of H^+ and nucleophilic attack
2) nucleophilic attack, transfer of H^- and transfer of H^+
3) electrophilic attack by OH^-, transfer of H^+ and transfer of H^-
4) transfer of H^+, nucleophilic attack and transfer of H^-

52. Which one of the following is an example for homogeneous catalysis?

1) Manufacture of ammonia by Haber's process
2) Manufacture of sulphuric acid by contact process
3) Hydrogenation of oil
4) Hydrolysis of sucrose in presence of dilute hydrochloric acid

53. The empirical formula of a nonelectrolyte is $C_1H_2O_1$. A solution containing 6 g of the compound exerts the same osmotic pressure as that of 0.05 M glucose solution at the same temperature. The molecular formula of the compound is .....

1) $C_3H_6O_3$ 2) $C_2H_4O_2$
3) $C_4H_8O_4$ 4) $C_5H_{10}O_5$

54. A white crystalline salt *A* reacts with dilute *HCl* to liberate a suffocating gas *B* and also forms a yellow precipitate. The gas *B* turns potassium dichromate acidified with dilute H_2SO_4 to a green coloured solution *C*. *A*, *B* and *C* are respectively .....

1) $Na_2S_2O_3$, SO_2, $Cr_2(SO_4)_3$ 2) Na_2SO_3, SO_2, $Cr_2(SO_4)_3$
3) Na_2SO_4, SO_2, $Cr_2(SO_4)_3$ 4) Na_2S, SO_2, $Cr_2(SO_4)_3$

55. Molecules of a noble gas do not possess vibrational energy because a noble gas .....

1) is chemically inert 2) is monoatomic
3) is diamagnetic 4) has completely filled shells

(Space for Rough Work)

56. One dm^3 solution containing 10^{-5} moles each of Cl^- ions and CrO_4^{-2} ions is treated with 10^{-4} mole of silver nitrate. Which one of the following observations is made?

$\left[K_{SP}\ Ag_2CrO_4 = 4\times10^{-12}\right]$

$\left[K_{SP}\ AgCl = 1\times10^{-10}\right]$

1) Silver chromate gets precipitated first.
2) Precipitation does not occur.
3) Both silver chromate and silver chloride start precipitating simultaneously.
4) Silver chloride gets precipitated first.

57. pH value of which one of the following is not equal to one?

1) 0.05 M H_2SO_4
2) 0.1 M HNO_3
3) 50 cm^3 of 0.4 M HCl + 50 cm^3 of 0.2 M $NaOH$
4) 0.1 M CH_3COOH

58. E_1, E_2 and E_3 are the emf values of the three galvanic cells respectively.

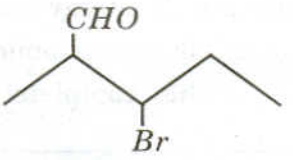
a) $Zn \mid Zn^{+2}_{1M} \parallel Cu^{+2}_{0.1M} \mid Cu$

b) $Zn \mid Zn^{+2}_{1M} \parallel Cu^{+2}_{1M} \mid Cu$

c) $Zn \mid Zn^{+2}_{0.1M} \parallel Cu^{+2}_{1M} \mid Cu$

Which one of the following is true?

1) $E_3 > E_2 > E_1$
2) $E_2 > E_3 > E_1$
3) $E_1 > E_3 > E_2$
4) $E_1 > E_2 > E_3$

59. The IUPAC name of 

is .....

1) 3-bromo-2-methylbutanal
2) 2-methyl-3-bromohexanal
3) 3-bromo-2-methylpentanal
4) 2-methyl-3-bromobutanal

60. Which one of the following forms propanenitrile as the major product?

1) Propyl bromide + alcoholic KCN
2) Ethyl bromide + alcoholic KCN
3) Ethyl bromide + alcoholic $AgCN$
4) Propyl bromide + alcoholic $AgCN$

(Space for Rough Work)

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MATHEMATICS

1. The chord of the circle $x^2+y^2-4x=0$ which is bisected at (1, 0) is perpendicular to the line .....

   1) $x=1$ 2) $y=1$

   3) $y=x$ 4) $x+y=0$

2. In ΔABC, if $a=2$, $B=Tan^{-1}\frac{1}{2}$ and $C=Tan^{-1}\frac{1}{3}$, then $(A, b)=$

   1) $\left(\frac{3\pi}{4}, \frac{2\sqrt{2}}{\sqrt{5}}\right)$ 2) $\left(\frac{\pi}{4}, \frac{2}{\sqrt{5}}\right)$

   3) $\left(\frac{3\pi}{4}, \frac{2}{\sqrt{5}}\right)$ 4) $\left(\frac{\pi}{4}, \frac{2\sqrt{2}}{\sqrt{5}}\right)$

3. The straight line $2x+3y-k=0$, $k>0$ cuts the X- and Y-axes at A and B. The area of ΔOAB, where O is the origin, is 12 sq. units. The equation of the circle having AB as diameter is .....

   1) $x^2+y^2-6x+4y=0$ 2) $x^2+y^2-4x-6y=0$

   3) $x^2+y^2-6x-4y=0$ 4) $x^2+y^2+4x-6y=0$

4. Let $P(x, y)$ be the midpoint of the line joining (1, 0) to a point on the curve $y^2=\begin{vmatrix} x+1 & x+2 \\ x+3 & x+5 \end{vmatrix}$. The locus of P is symmetrical about .....

   1) $x=1$ 2) $y=1$

   3) Y–axis 4) X–axis

5. The function $f(x)=|x-2|+x$ is .....

   1) continuous at $x = 2$ but not at $x = 0$.
   2) continuous at both $x = 2$ and $x = 0$.
   3) differentiable at both $x = 2$ and $x = 0$.
   4) differentiable at $x = 2$ but not at $x = 0$.

(Space for Rough Work)

6. If $a, -a, b$ are the roots of $x^3 - 5x^2 - x + 5 = 0$, then b is a root of .....

1) $x^2 - 3x - 10 = 0$ 2) $x^2 + 5x - 30 = 0$

3) $x^2 + 3x - 20 = 0$ 4) $x^2 - 5x + 10 = 0$

7. In the binomial expansion of $(1+x)^{15}$, the coefficients of x^r and x^{r+3} are equal. Then r is .....

1) 4 2) 6

3) 8 4) 7

8. The n^{th} term of the series 1 + 3 + 7 + 13 + 21 + ... is 9901. The value of n is .....

1) 900 2) 99

3) 100 4) 90

9. If $\frac{1}{(3-5x)(2+3x)} = \frac{A}{3-5x} + \frac{B}{2+3x}$, then $A : B$ is .....

1) 3 : 5 2) 3 : 2

3) 2 : 3 4) 5 : 3

10. Which of the following is NOT true?

1) $p \to (q \wedge r) \equiv (p \to q) \wedge (p \to r)$.

2) $\sim (p \leftrightarrow q) \equiv (p \wedge \sim q) \vee (\sim p \wedge q)$.

3) $(p \wedge \sim q) \leftrightarrow (p \to q)$ is a tautology.

4) $\{(p \to q) \wedge (q \to r)\} \to (p \to r)$ is a tautology.

(Space for Rough Work)

11. Let R be an equivalence relation defined on a set containing 6 elements. The minimum number of ordered pairs that R should contain is .....

1) 64 2) 36
3) 12 4) 6

12. The line joining $A(2, -7)$ and $B(6, 5)$ is divided into 4 equal parts by the points P, Q and R such that $AQ = RP = QB$. The midpoint of PR is .....

1) $(4, -1)$ 2) $(8, -2)$
3) $(4, 12)$ 4) $(-8, 1)$

13. Let $P \equiv (-1, 0)$, $Q \equiv (0, 0)$ and $R \equiv \left(3, 3\sqrt{3}\right)$ be three points. The equation of the bisector of the angle PQR is .....

1) $x + \sqrt{3}\,y = 0$ 2) $\sqrt{3}\,x + y = 0$
3) $x - \sqrt{3}\,y = 0$ 4) $\sqrt{3}\,x - y = 0$

14. If m is the slope of one of the lines represented by $ax^2 + 2hxy + by^2 = 0$, then $(h + bm)^2 =$ .....

1) $h^2 + ab$ 2) $h^2 - ab$
3) $(a + b)^2$ 4) $(a - b)^2$

15. $Cot\,12^0 Cot\,102^0 + Cot\,102^0 Cot\,66^0 + Cot\,66^0 Cot\,12^0 =$ .....

1) -1 2) 2
3) -2 4) 1

(Space for Rough Work)

16. $(Sin\theta + Cos\theta)(Tan\theta + Cot\theta) =$ .....

1) $Sec\theta + Cosec\theta$ 2) $Sec\theta \cdot Cosec\theta$

3) $Sin\theta \cdot Cos\theta$. 4) 1

17. The sides of a triangle are $6+\sqrt{12}$, $\sqrt{48}$ and $\sqrt{24}$. The tangent of the smallest angle of the triangle is .....

1) $\sqrt{3}$ 2) 1

3) $\frac{1}{\sqrt{3}}$ 4) $\sqrt{2}-1$

18. A simple graph contains 24 edges. Degree of each vertex is 3. The number of vertices is .....

1) 21 2) 16

3) 8 4) 12

19. $\lim_{n \to \infty} \left\{ n Sin \frac{2\pi}{3n} \cdot Cos \frac{2\pi}{3n} \right\} =$ .....

1) 1 2) $\frac{\pi}{3}$

3) $\frac{\pi}{6}$ 4) $\frac{2\pi}{3}$

20. The function $f(x) = [x]$, where $[x]$ denotes the greatest integer not greater than x, is...

1) continuous for all real values of x.
2) continuous only at rational values of x.
3) continuous for all nonintegral values of x.
4) continuous only at positive integral values of x.

(Space for Rough Work)

21. If $a > b > 0$, $Sec^{-1}\left(\frac{a+b}{a-b}\right) = 2Sin^{-1}x$, then $x =$ .....

1) $-\sqrt{\frac{a}{a+b}}$ 2) $\sqrt{\frac{a}{a+b}}$

3) $-\sqrt{\frac{b}{a+b}}$ 4) $\sqrt{\frac{b}{a+b}}$

22. If $x \neq n\pi, x \neq (2n+1)\frac{\pi}{2}, n \in Z$, then $\frac{Sin^{-1}(Cos\,x) + Cos^{-1}(Sin\,x)}{Tan^{-1}(Cot\,x) + Cot^{-1}(Tan\,x)} =$ .....

1) $\frac{\pi}{4}$ 2) $\frac{\pi}{3}$

3) $\frac{\pi}{2}$ 4) $\frac{\pi}{6}$

23. The general solution of $1 + Sin^2x = 3Sin\,x \cdot Cos\,x, Tan\,x \neq \frac{1}{2}$ is .....

1) $n\pi - \frac{\pi}{4},\ n \in Z$ 2) $n\pi + \frac{\pi}{4},\ n \in Z$

3) $2n\pi + \frac{\pi}{4},\ n \in Z$ 4) $2n\pi - \frac{\pi}{4},\ n \in Z$

24. The least positive integer n, for which $\frac{(1+i)^n}{(1-i)^{n-2}}$ is positive, is .....

1) 1 2) 2

3) 3 4) 4

25. If $x + iy = \left(-1 + i\sqrt{3}\right)^{2010}$, then $x =$ .....

1) 1 2) -1

3) -2^{2010} 4) 2^{2010}

(Space for Rough Work)

26. The greatest value of x satisfying $21 \equiv 385 \pmod{x}$ and $587 \equiv 167 \pmod{x}$ is .....

1) 28 2) 56
3) 156 4) 32

27. The number $(49^2 - 4)(49^3 - 49)$ is divisible by .....

1) 6! 2) 5!
3) 7! 4) 9!

28. The least positive integer x satisfying $2^{2010} \equiv 3x \pmod{5}$ is .....

1) 1 2) 2
3) 3 4) 4

29. If A and B are two square matrices of the same order such that $AB = B$ and $BA = A$, then $A^2 + B^2$ is always equal to .....

1) $2AB$ 2) $2BA$
3) I 4) $A + B$

30. If A is a 3×3 nonsingular matrix and if $|A| = 3$, then $\left|(2A)^{-1}\right|$ = ...

1) $\frac{1}{3}$ 2) $\frac{1}{24}$
3) 24 4) 3

(Space for Rough Work)

31. If $A = \begin{bmatrix} 3 & 2 \\ 1 & 1 \end{bmatrix}$, then $A^2 + xA + yI = 0$ for $(x, y) =$ .....

1) $(4, -1)$ 2) $(1, 3)$

3) $(-4, 1)$ 4) $(-1, 3)$

32. The constant term of the polynomial $\begin{vmatrix} x+3 & x & x+2 \\ x & x+1 & x-1 \\ x+2 & 2x & 3x+1 \end{vmatrix}$ is .....

1) -1 2) 1

3) 0 4) 2

33. If $\vec{a}$, $\vec{b}$ and $\vec{c}$ are nonzero coplanar vectors, then $\left[2\vec{a}-\vec{b} \quad 3\vec{b}-\vec{c} \quad 4\vec{c}-\vec{a} \right]$ = ...

1) 27 2) 9

3) 25 4) 0

34. A space vector makes the angles 150^0 and 60^0 with the positive direction of X- and Y-axes. The angle made by the vector with the positive direction of Z-axis is .....

1) 180^0 2) 120^0

3) 90^0 4) 60^0

35. If $\vec{a}$, $\vec{b}$ and $\vec{c}$ are unit vectors, such that $\vec{a}+\vec{b}+\vec{c} = \vec{0}$, then $3\vec{a}\cdot\vec{b} + 2\vec{b}\cdot\vec{c} + \vec{c}\cdot\vec{a}$ = ...

1) -3 2) 3

3) -1 4) 1

(Space for Rough Work)

36. If i, j, k are unit vectors along the positive direction of X-, Y- and Z-axes, then a FALSE statement in the following is .....

1) $\sum i \cdot (j \times k) = 0$
2) $\sum i \cdot (j + k) = 0$
3) $\sum i \times (j + k) = \vec{0}$
4) $\sum i \times (j \times k) = \vec{0}$

37. In $P(X)$, the power set of a nonempty set X, a binary operation * is defined by $A * B = A \cup B \ \forall \ A, B \in P(X)$. Under *, a TRUE statement is .....

1) commutative law is not satisfied.
2) associative law is not satisfied.
3) identity law is not satisfied.
4) inverse law is not satisfied.

38. The inverse of 2010 in the group Q^+ of all positive rationals under the binary operation * defined by $a * b = \frac{ab}{2010}, \ \forall \ a, b \in Q^+$, is .....

1) 1
2) 2010
3) 2009
4) 2011

39. If the three functions $f(x)$, $g(x)$ and $h(x)$ are such that $h(x) = f(x) \cdot g(x)$ and $f'(x) \cdot g'(x) = c$, where c is a constant, then $\frac{f''(x)}{f(x)} + \frac{g''(x)}{g(x)} + \frac{2c}{f(x) \cdot g(x)}$ is equal to .....

1) $\frac{h''(x)}{h(x)}$
2) $\frac{h(x)}{h'(x)}$
3) $h'(x) \cdot h''(x)$
4) $\frac{h(x)}{h''(x)}$

40. The derivative of $e^{ax} \, Cos bx$ with respect to x is $re^{ax} \, Cos\left(bx + Tan^{-1}\frac{b}{a}\right)$. When $a > 0$, $b > 0$, the value of r is .....

1) ab
2) $a + b$
3) $\sqrt{a^2 + b^2}$
4) $\frac{1}{\sqrt{ab}}$

(Space for Rough Work)

41. If $x = a\,Cos^3\theta$ and $y = a\,Sin^3\theta$, then $\frac{dy}{dx} =$ .....

1) $-\sqrt[3]{\frac{x}{y}}$ 2) $-\sqrt[3]{\frac{y}{x}}$

3) $\sqrt[3]{\frac{y}{x}}$ 4) $\sqrt[3]{\frac{x}{y}}$

42. If $y = Tan^{-1}\sqrt{x^2-1}$, then the ratio $\frac{d^2y}{dx^2} : \frac{dy}{dx} =$ .....

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

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

43. P is the point of contact of the tangent from the origin to the curve $y = Log_e x$. The length of the perpendicular drawn from the origin to the normal at P is .....

1) $2\sqrt{e^2+1}$ 2) $\sqrt{e^2+1}$

3) $\frac{1}{2e}$ 4) $\frac{1}{e}$

44. For the curve $4x^5 = 5y^4$, the ratio of the cube of the subtangent at a point on the curve to the square of the subnormal at the same point is .....

1) $\left(\frac{4}{5}\right)^4$ 2) $\left(\frac{5}{4}\right)^4$

3) $x\left(\frac{4}{5}\right)^4$ 4) $y\left(\frac{5}{4}\right)^4$

45. The set of real values of x for which $f(x) = \frac{x}{Log\,x}$ is increasing, is .....

1) $\{x : x < e\}$ 2) $\{1\}$

3) $\{x : x \geq e\}$ 4) empty

(Space for Rough Work)

46. A wire of length 20 cm is bent in the form of a sector of a circle. The maximum area that can be enclosed by the wire is .....

1) 10 sq. cm 2) 30 sq. cm

3) 20 sq. cm 4) 25 sq. cm

47. Two circles centered at (2, 3) and (5, 6) intersect each other. If the radii are equal, the equation of the common chord is .....

1) $x+y-8=0$ 2) $x-y-8=0$

3) $x+y+1=0$ 4) $x-y+1=0$

48. Equation of the circle centered at (4, 3) touching the circle $x^2+y^2=1$ externally, is .....

1) $x^2+y^2+8x-6y+9=0$ 2) $x^2+y^2-8x+6y+9=0$

3) $x^2+y^2-8x-6y+9=0$ 4) $x^2+y^2+8x+6y+9=0$

49. The points (1, 0), (0, 1), (0, 0) and $(2k,\ 3k)$, $k \neq 0$ are concyclic if k = ...

1) $-\frac{5}{13}$ 2) $\frac{5}{13}$

3) $\frac{1}{5}$ 4) $-\frac{1}{5}$

50. The locus of the point of intersection of the tangents drawn at the ends of a focal chord of the parabola $x^2=-8y$ is .....

1) $y=2$ 2) $y=-2$

3) $x=2$ 4) $x=-2$

(Space for Rough Work)

51. The condition for the line $y = mx + c$ to be a normal to the parabola $y^2 = 4ax$ is .....

1) $c = \frac{a}{m}$ 2) $c = 2am + am^3$

3) $c = -2am - am^3$ 4) $c = -\frac{a}{m}$

52. The eccentric angle of the point $\left(2, \sqrt{3}\right)$ lying on $\frac{x^2}{16} + \frac{y^2}{4} = 1$ is .....

1) $\frac{\pi}{3}$ 2) $\frac{\pi}{6}$

3) $\frac{\pi}{4}$ 4) $\frac{\pi}{2}$

53. The distance of the focus of $x^2 - y^2 = 4$, from the directrix which is nearer to it, is .....

1) $2\sqrt{2}$ 2) $\sqrt{2}$

3) $4\sqrt{2}$ 4) $8\sqrt{2}$

54. If $\int f(x) Sin x \cdot Cos x \, dx = \frac{1}{2\left(b^2 - a^2\right)} Log f(x) + c$, where c is the constant of integration, then $f(x) =$ .....

1) $\frac{2}{ab\,Sin\,2x}$ 2) $\frac{2}{\left(b^2 - a^2\right) Sin\,2x}$

3) $\frac{2}{ab\,Cos\,2x}$ 4) $\frac{2}{\left(b^2 - a^2\right) Cos\,2x}$

55. If $\int \frac{\sqrt{x}}{x(x+1)} dx = k\,Tan^{-1} m$, then (k, m) is .....

1) $\left(1, \sqrt{x}\right)$ 2) $\left(2, \sqrt{x}\right)$

3) $(2, x)$ 4) $(1, x)$

(Space for Rough Work)

56. $\int_0^{\pi/4} \frac{Sin\,x + Cos\,x}{3 + Sin\,2x}\,dx =$ .....

1) $\frac{1}{2}\,Log\,3$ 2) $2\,Log\,3$

3) $\frac{1}{4}\,Log\,3$ 4) $Log\,3$

57. $\int_0^1 x\,(1-x)^{3/2}\,dx =$ .....

1) $\frac{24}{35}$ 2) $\frac{-8}{35}$

3) $\frac{-2}{35}$ 4) $\frac{4}{35}$

58. The area bounded by the curve $y = \begin{cases} x^2, & x < 0 \\ x, & x \geq 0 \end{cases}$ and the line $y = 4$ is .....

1) $\frac{40}{3}$ 2) $\frac{16}{3}$

3) $\frac{32}{3}$ 4) $\frac{8}{3}$

59. The order and degree of the differential equation $y = \frac{dp}{dx}x + \sqrt{a^2p^2 + b^2}$ where $p = \frac{dy}{dx}$ (here a and b are arbitrary constants) respectively are .....

1) 1, 2 2) 2, 1

3) 2, 2 4) 1, 1

60. The general solution of the differential equation $2x\,\frac{dy}{dx} - y = 3$ is a family of .....

1) straight lines 2) circles

3) hyperbolas 4) parabolas

(Space for Rough Work)