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Roshni Patil
ME (WCC)
4th Sem. S-19
1st Rank

Priyanka Sahare
ME(WCC)
4th Sem. S-19
1st Rank

Diksha Wasnik
M.Tech (IPS)
4th Sem S-19
1st Rank

Sumit Paul
M.Tech. (SE)
1st Rank

Sneha Udam
BE (ECE)
8th Sem S-19
1st Rank

Ruchika Gedam
MCA
4th Sem S-19
1st Rank

Anil Tekale
M.Tech (IPS)
4th Sem S-19
2nd Rank

Gayatri Pasare
ME (WCC)
4th Sem S-19
2nd Rank

Harshal Gode
ME (WCC)
4th Sem S-19
3rd Rank

Seema Kuhikar
MCA
4th Sem S-19
3rd Rank

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M.Tech (SE)
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Laxmi Sharma
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8th Sem S-19
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S.No.	Course Name	Intake
1.	Mechanical Engineering	240
2.	Electrical Engineering	180
3.	Computer Science and Engineering	120
4.	Civil Engineering	60
5.	Information Technology	60
6.	Electronics and Comm. Engineering	60
7.	Electronics Engineering	60
8.	Aeronautical Engineering★	60
9.	Biotechnology★	60

Post-Graduate (M.E./M.Tech./MCA/MBA)

S.No.	Course Name	Intake
1.	Computer Science & Engineering	36
2.	Electronics Engg. (Communication)	24
3.	Wireless Comm. & Computing	24
4.	Integrated Power Systems	48
5.	Structural Engineering	24
6.	Mechanical Engineering Design	24
7.	Artificial Intelligence & Machine Learning★	24
8.	Master in Computer Application	60
9.	Master of Business Administration	120

Polytechnic (Post SSC Diploma) - 2nd Shift

S.No.	Course Name	Intake
1.	Civil Engineering	60
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3.	Computer Science & Engg.	120
4.	Mechanical Engineering	120

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★ Indicates proposed courses for session 2020-21

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Director MGIRI, Wardha
Inaugurated International Conference MPIR-19

Hon'ble Shri Nitinji Gadkari
Minister of Road Transport and Highways India visited the college campus

Hon'ble Shri. Vikas Thakare
Nagpur City President of Congress
Inaugurated with students for Bhehtar Bharat

Hon'ble Dr. S.P. Kane
Vice Chancellor, RTM, Nagpur University
Inaugurated the Journal "Tech-Chronicle"

Hon'ble Dr. Dinesh Keskar
President of Boeing India,
Inaugurated National Convention "Quark"

Events

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International Conference "ICIREST-19"

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DETAILED SOLUTION
OF
MOCK-CET TEST
PAPER - # 01

(As Per MHT-CET Exam)

(Dated on 12/05/2020)

Subject: Physics

Q. 1. If a car at rest accelerated uniformly to a speed of 144 km/hour in 20 second it covers a distance

Q.1 Ans (A) :- u = 0, v = 144 km/hr = 144*5/18
= 40 m/s

V= u + at

a = $\frac{v-u}{t} = \frac{40-0}{20} = 2m/s^2$

s = ut + $\frac{1}{2}\ at^2$

s = $\frac{1}{2} \times 2 \times (20)^2$

s= 400 m

Q. 2 A body of mass 5 kg is moving in a circle of radius 1 m with an angular velocity of 2 rad/sec. Then the centripetal acceleration (in m/s^2) will be

Q.2 Ans (D) :- Centripetal acceleration = ω^2 r= 2x2x1

= $4m/s^2$

= 20 N

Q 3. The rocket engine lift a rocket from the earth, because hot gases

Q.3Ans (B) :- When the rocket gas pushes it against the earth with high velocity, there is production reaction force which creates lift for the rocket.

Q. 4. A spring 40 mm long is stretched by applying a force. If 10 N force is required to stretch the spring through one mm, then work done in stretching the spring through 40 mm is

Q.4 Ans (B) :- Force constant

$K = F = \frac{10}{x\ \ 0.001} = 10^4$ N/m

Work done $= \frac{1}{2} kx^2 = \frac{1}{2} \times 10^4 \times \left(\frac{40}{1000}\right)^2$

$= \frac{1 \times 10^4 \times 16}{2 \ * \ 10^4} =$ 8 joule

Q 5 If there is change of angular momentum from 1J to 5 J in 5 second. Then the torque is

Q.5Ans (B) :-

Torque = $dL/dt = \frac{\Delta L}{\Delta t'}$

Here $\Delta L = 5J - J = 4J$

$\Delta t = 5$ sec torque = $\frac{4\ J}{5}$

Q 6. Gravitational mass is proportional to the gravitational

Q.6 Ans (C) :- Inertial mass is free from gravitational force. It depends upon only mass. Gravitational mass is dependent on gravitational force.

Q 7. If in a wire of Young's modulus Y, longitudinal strain X is produced then the potential energy stored in its unit volume will be

Q.7Ans (A) :- Potential energy stored per unit volume of a wire

$= \frac{1}{2}$ x Stress x Strain

$= \frac{1}{2}$ x Y x X x X [Stress = Y x X]

$= 0.5YX^2$

Q 8. A big drop of radius R is formed by 729 small drops of water of radius r, then the radius of each small drop will be

Q.8 Ans (A) :- Equating volume in both cases,

$= \frac{4}{3}\pi R^3 = 729 \times \frac{4}{3}\pi R^3$

$\Rightarrow r^3 = \frac{R^3}{729}$

$\Rightarrow r = \frac{R}{9}$

Q 9. If the temperature of a black body increases from 7°C to 287°C, then the rate of emission of radiation energy is:

Q.9 Ans (B) :- For block body radiation

$E = \sigma T^4$

[E is energy radiated per unit time per unit area, T is temperature of the body]

$$\frac{E_2}{E_1} = \left(\frac{T_2}{T_1}\right)^4 \Rightarrow \frac{E_2}{E_1} = \left(\frac{273+287}{273+7}\right)^4$$
$$= \left(\frac{560}{280}\right)^4 \Rightarrow \frac{16}{1} = E_2 = 16E_1$$

Q 10. During the adiabatic expansion of two moles of a gas the internal energy of a gas is found to decrease by 2 joule. The work done on gas during the process will be equal to

Q.10 Ans (A) :- Gas is expanding at the cost of internal energy of the gas. Work done by the gas is 2 joule. So work done on the gas = - 2 joule.

Q 11. If the time period of oscillation of mass m suspended from a spring is 2 sec, the time period of mass 4 m will be :

Q.11 Ans (c) :-

$T=2\pi\sqrt{\frac{m}{k}} \Rightarrow 2= T = {}^{2=2\pi}\sqrt{\frac{m}{k}}$

$T'=2\pi\sqrt{\frac{4m}{k}} \Rightarrow 2= T' = 2x2\pi\sqrt{\frac{m}{k}}$

T' = 2x2 = 4sec

Q 12. The wave equation is y = 0.30 sin (314t – 1.57x) where t, x and y are in second, metre and centimetre respectively. The speed of the wave is

Q.12 Ans (C) :- Given equation y = 0.30 sin (314t – 1.57x)

Comparing it with standard equation of wave,

Y = a sin (ωt – kx)

ω = 314; k = 1.57

v = $\frac{\omega}{k} \Rightarrow$v = $\frac{314}{1.57}$ = 200m/sec

Q 13. The point charges Q and –2Q are placed at some distance apart. If the electric field at the location of Q is E. The electric field at the location of Q is E. The electric field at the location of –2Q will be

Q.13 Ans (C):- Field at Q is E. So, force on Q = QE

This force will be applied on – 2Q. Also

According to Coulomb's law. So, field

At – 2Q is $\frac{QE}{-2Q} = \frac{E}{2}$

Q 14. Minimum numbers of 8mF and 250 V capacitors are used to make a combination of 16mF and 1000V are:

Q.14 Ans (B):- μ←-----1000 V--------→

HHHHH

To create 1000 V, we need to combine 4 capacitors in series. Total capacity

Becomes = $\frac{8\mu F}{4}$ = 2μF. In order to obtain capacity of 16μF, 8 rows of this combination will be needed in parallel.

Total capacity = 2μF x 8 = 16μF. Total number of capacitor = 4 x 8 = 32

Q 15. Two filaments of same length are connected first in series then in parallel. For the same amount of main current flowing, the ratio of the heat produced is:

Q.15 Ans (D):- Two 4Ω resistors are in parallel so, their total resistance $= 2\Omega$. Now three 2Ω $resistors\ \ are\ in\ series$. their total resistance will be 6Ω

Q 16. Cyclotron is used to accelerate

Q.16 Ans (A) :- Cyclotron is used to accelerate positive ions. Electron can not be used as its velocity increases appreciably resulting into its mass becoming very large. It creates problem in synchronization.

Q 17. The magnetic susceptibility of an ideal diamagnetic substance is

Q.17 Ans (A) :- The field is entering into the surface so flux is negative.

Q 18. In a coil of self inductance of 5 henry, the rate of change of current is 2 ampere per second, the e.m.f. induced in the coil is :

Q.18 Ans (D) :- e.m.f. = - L $\frac{di}{dt}$ = 5 x 2 = - 10V

Q 19. Turn ratio in a step up transformer is 1 : 2 if a Lechlanche cell of 1.5 V is connected across the input, then the voltage across the output will be

Q.19 Ans (D) :- A transformer can not step up a.d.c. input so output potential here will be zero. No potential will be induced in the secondary coil.

Q 20. Which wavelength of sun is used finally as electric energy?

Q.20 Ans (B) :- The heating property of Infra red waves is used in solar heater and solar cells. Hence option(b) correct.

Q 21. Two waves of intensities I and 4I superimposes. Then the maximum and minimum intensities are

Q.21 Ans (A):- Ratio of amplitudes = $\sqrt{\frac{4}{1}} = \frac{2}{1}$

$\frac{maximum\ amplitude}{minimum\ amplitude} = \frac{2+1}{2-1} = \frac{3}{1}$

$\frac{maximum\ intensity}{minimum\ intensity} = \left(\frac{3}{1}\right)^2 = \frac{9}{1}$

Q 22. The radius of hydrogen atom in the first excited level is :

Q.22 Ans (B) :- Radius of H-atom $\propto n^2$

So for excitation from n 1 to n =2, radius becomes 4 times.

Q 23. The activity of a radioactive sample is 1.6 curie and its half life is 2.5 days. Then activity after 10 days will be :

Q.23 Ans (C) :- After every 2.5 days its activity reduces to half the value,

10 days= 10/2.5= 4 half lives

Reduced activities= $1.6 \times (\frac{1}{2})^4 = 0.1$ curie

Q 24. A ball is dropped from a bridge 122.5 m high. After the first ball has fallen for 2 second, a second ball is thrown straight down after it, what must be the initial velocity of the second ball be, so that both the balls hit the surface of water at the same time?

Q.24 Ans (A) :- Time taken by the first object to reach the ground = t, so

$122.5\ ut\ + \frac{1}{2} = gt^2$

$122.5\ \frac{1}{2}$ x 10 x t^2

$\Rightarrow$ t = 5 sec (approx)

Time to be taken by the second ball to reach the ground = 5 – 2 = 3 sec.

If u be its intial velocity then,

$122.5\ u$ x $3\ + \frac{1}{2} = gt^2 = 3u\ + \frac{1}{2}$ x 10 x 9

3u = 122.5 – 45 = 77.5

u = 26 (approx.)

Q 25. A body is projected at such angle that the horizontal range is three times the greatest height. The angle of projection is

Q.25 Ans (B) :- $R = 3\ H\ ; R = \frac{u^2 \sin 2\ \theta}{g}$; H = $\frac{u^2\ \sin^2\ \theta}{2g}$

$\frac{u^2 \sin 2\ \theta}{g} = \frac{3u^2\ \sin^2\ \theta}{2g}$

$2 \sin\theta \cos\theta = \frac{3\ \sin^2\ \theta}{2}$

$\tan\theta = \frac{4}{3} \Rightarrow \theta = 53.7'$

Q 26. A gun fires a bullet of mass 50 g with a velocity of 30 m/s. Due to this, the gun is pushed back with a velocity of 1 m/s, then the mass of the gun is :

Q.26 Ans (A) :- Applying conservation of momentum MV = mv

$$M \times 1 = \frac{50}{1000} \times 30 = \frac{3}{2}$$

M = 1.5kg

Q 27. If the kinetic energy of the body becomes four times of its initial value, then the new momentum will :

Q.27 Ans :- $E = \frac{p^2}{2m}$; $E \propto p^2$

$$\frac{E_1}{E_2} = \frac{p1^2}{p2^2} \Rightarrow \frac{1}{4} = \left(\frac{p1}{p2}\right)^2 \Rightarrow \frac{p1}{p2} = \frac{1}{2}$$

Ratio of momentum = 1 : 2

Q 28. The motion of planets in the solar system is an example of the conservation of :

Q.28 Ans (C):- For any circular motion the angular momentum is conserved as no torque is acting on it because centripetal force acts through the point of axis.

Q 29. Escape velocity of a body when projected from the earth's surface is 11.2 km/sec. If it is projected at an angle of 50° from the horizontal, then escape velocity is:

Q.29 Ans (C) :- Escape velocity does not depend on the direction of throw of object. This is because gravitational field is a conservative field.

Q 30. Which one of the following affects the elasticity of a substance ?

Q.30 Ans (D) :- The elasticity of a material depends upon the temperature of the material. Hammering & annealing reduces elastic property of a substance.

Q 31. A soap bubble in vacuum has a radius 3 cm and another soap bubble in vacuum has radius 4 cm. If two bubbles coalesce under isothermalcondition. Then the radius of the new bubble will be :

Q.31 Ans (B):- If r_1, r_2, r be radius of soap bubbles before and after the coalesce &p_1, p_2 and p the pressure then, applying gas laws equation.

$$p_1v_1 + p_2v_2 = pV$$

$$\frac{4T}{r_1} \times \frac{4}{3}\pi {r_1}^3 + \frac{4T}{r_2} \times \frac{4}{3}\pi {r_2}^3 = \frac{4T}{r} \times \frac{4}{3}\pi r^3$$

$${r_1}^3 + {r_2}^2 = r^2$$

$$3^2 + 4^2 = r^2 \Rightarrow \sqrt{25} = 5cm$$

Q 32. The thermal conductivity of a rod is 2. What is its thermal resistivity ?

Q.32 Ans (A) :- Conductivity = $\frac{1}{Resistivity}$

Thermal conductivity = 2

Thermal resistivity = $\frac{1}{2}$ = 0.5

Q 33. The latent heat of vaporization of water is 2240 J. If the work done in the process of vaporization of 1g is 168 J, then increase in internal energy is

Q.33 Ans (B) :- We know that for first law of thermodynamics equation is

Q = ΔE + ΔW

Here, Q = 2240; ΔE = ?ΔW = 168

ΔE = Q – ΔW = 2240 – 168 = 2072J

Q 34. If a simple pendulum oscillates with an amplitude of 50 mm and time period of 2 sec then its maximum velocity is

Q.34 Ans (B) :- v = $\omega\sqrt{a^2 - u^2};\ when\ u = 0, V = v$

So, $r_{max} = \omega a$

[where ω is angular velocity and a is amplitude]

$v_{max} = \frac{2\pi}{T} x\ a = \frac{2\pi}{T} x \frac{50}{1000} = 0.16 m/sec$

Q 35. An object producing a pitch of 1200 Hz is moving with a velocity of 50 m/s towards a stationary person. The velocity of sound is 350 m/s. The frequency of sound heard by the stationary person is :

Q.35 Ans (D) :- If n_a be the apparent frequency, then

$n_a = n\ x \frac{v_S}{(vs - v_0)} = \frac{1200\ x\ 350}{(350 - 50)}$

$= \frac{1200\ x\ 350}{300}$ =1400Hz

Q 36. A particle of mass 2g and charge mC1 is held at a distance of 1m from a fixed charge 1mC. If the particle is released it will be repelled. The speed of particle when it is at a distance of 10 metre from the fixed charge is

Q.36 Ans (A) :- Potential at 1 m from the charge

$V_A = \frac{K.10^{-6}}{1} = K \times 10^{-6}$

Potential at 10m from the charge

$V_B = \frac{K.10^{-6}}{10} = K \times 10^{-7}$

Potential diff = $V_A - V_B = K(10^{-6} - 10^{-7})$

Its velocity at 10 m is v, then

$\frac{1}{2} \times mv^2 = (V_A - V_B) \times q$

$\frac{1}{2} \times 2 \times 10^{-2} \times v^2 = K \times 10^{-6}\left(1 - \frac{1}{10}\right) \times 10^{-3}$

$v^2 = \frac{k \times 10^{-9} \times 9}{10^{-3}10} = K \times \frac{9}{10} \times 10^{-6}$

$= 9 \times 10^{-9} \frac{9}{10} \times 10^{-6} = 81 \times 100$

v = 90 m/sec

Q 37. Equipotential surfaces associated with an electric field which is increasing in magnitude along the x-direction are :

Q.37 Ans (A) :- Equipotential surface is always perpendicular to the direction of electric field.

As the field is along x- direction, equipotential surface must be parallel to yz-plane.

Q 38. Angle of dip is 90° at

Q.38 Ans (C):- At poles angle of dip will be 90^0 because earth's magnetic field will be almost vertical there.

Q 39. A conducting ring of radius 1 metre is placed in an uniform magnetic field B of 0.01 tesla oscillating with frequency 100 Hz with its plane at right angle to B. What will be the induced electric field ?

Q.39Ans (B) :- A changing magnetic field gives rise to electric field as shown in the figure….

The relation between electric field and changing magnetic field is

$$\oint Edl = \frac{d\Phi}{dt} = \frac{dBA}{dt}$$

$2\pi rE = \frac{\pi r^2 dB}{dt} \Rightarrow E = \frac{r}{2}\frac{dB}{dt}$

Here dB = 0.01 – (-0.01) = 0.02

dt = $\frac{T}{2} = \frac{1}{2*100}$

E = $\frac{1}{2}$ x $\frac{0.02}{\frac{1}{2\times100}} = \frac{2\ x\ 100\ x\ 0.02}{2}$ = 2 volt

Q 40. A choke coil has:

Q.40 Ans (D):- A choke coil has high inductance and low resistance so, it is capable of producing very high induced e.m.f. which produces discharge in the tube.

Q 41. In an electron microscope the accelerating voltage is increased from 20 kV to 80 kV, the resolving power of the microscope will become

Q.41 Ans (A) :- We know that wavelength and accelerating voltage for an electron is related to each other as follows

$\lambda \propto \frac{1}{\sqrt{25}}$[V is potential applied]

And resolving power $\propto \frac{1}{\lambda}$

So, resolving power $\propto \sqrt{V}$

Now, if potential used is increased 2 times. So,

if resoling power earlier is R. It becomes 2R.

Q 42. When cathode rays strike a metal target of high melting point with a very high velocity then which of the following are produced ?

Q.42 Ans (C) :- When electrons strike a metal target of high melting point with high velocity, it knocks out inner electrons of the atoms of the target material. To fill up this vacancy electrons from higher energy level make transition to lower level resulting in emission of radiation. If target material has very high atomic number than the emitted radiation is X-ray.

Q 43. For an electron in the second orbit of hydrogen, the moment of momentum as per Bohr's model is

Q.43 Ans (A) : The moment of momentum is also known as angular momentum of electron .

We know from Bhor's theory that is an orbit

Angular momentum = n. $\frac{h}{2\pi}$

For second orbit n = 2

So, angular momentum = 2 x $\frac{h}{2\pi}$ = = $\frac{h}{\pi}$ $is\ the\ answer$.

Q 44. Which one of the following is used as a moderator in nuclear reaction ?

Q.44 Ans (B): Heavy water (D_2O) is used as a moderator in nuclear reaction.

Q 45. Sky wave propagation is not possible for frequencies

Q.45 Ans (C): Sky wave propagation is not possible for frequency > 30 MHz because they are not reflected by ionosphere.

Q 46. Two equal vectors have a resultant equal to either of them, then the angle between them will be

Q.46 Ans (B) : Applying the formula,

$R^2 = P^2 + Q^2 + 2PQ\cos\alpha$

$P^2 = P^2 + P^2 + 2PP\cos\alpha$

$= 2P^2 = 2P^2\cos\alpha = 2P^2(1+\cos\alpha)$

$\cos\alpha = \frac{\alpha}{2} = \frac{1}{4} \Rightarrow \cos = \frac{\alpha}{2} = \frac{1}{2} = \cos 60^0$

$\frac{\alpha}{2} = 60^0 \Rightarrow \alpha = 120^0$

Q 47. In communication with help of antenna if height is double then the range covered which was initially r would become

Q.47 Ans (A): Range of antenna = r $\sqrt{2hr}$, h = height of antenna,

R = radius of rarth

If h is doubled i.e., h' = 2h, then new range

r' = $\sqrt{2hr}$,

$\Rightarrow$ r' = $\sqrt{2hr} = \sqrt{2}\sqrt{2hr} = \sqrt{2}\ r$

Q 48. A bullet of mass 10g leaves a riffle at an initial velocity of 1000 m/sec and strikes the earth at the same level with a velocity of 500 m/sec. The work in overcoming the resistance of air will be:

Q.48 Ans (C): Loss of kinetic energy of bullet

= The work done in over coming air resistance

$\frac{1}{2}x\frac{10}{1000}$ (1000^2 - 500^2)

$\frac{1}{2}x\frac{10}{100}$ x 1000 x 500 = 3750J

Q 49. A disc is rolling without slipping on a straight surface. The ratio of its translational kinetic energy to its total kinetic energy is

Q.49 Ans (A) : TKE = $\frac{1}{2}$ mv^2

RKE = $\frac{1}{2}I\ \omega^2$

$\omega = v/R$

$\Rightarrow \frac{TKE}{TKE+RKE} = \frac{2}{3}$

Q 50. Hubble's law is related with

Q.50 Ans (B) : Hubble's law states that speed of a star is directly proportional to distance from the star i.e.

$V \propto r \Rightarrow v = Hr$

Subject: Chemistry

Q 1. Positron is :

Q.1 Ans (A) : Positron is electron with positive charge + 1e0

Q 2. The outermost configuration of most electronegative element is:

Q.2 Ans (A) : Most electronegative element corresponds to ns^2np^5 configuration

Q 3 The first ionisation potential is maximum for:

Q.3 Ans (D) : First ionization potential is maximum for hydrogen, as electron is withdrawn from from the first orbital which is very near to nucleus.

Q 4. Which element has high electron affinity?

Q.4 Ans (B) : CI has high electron affinity

Q 5 Which of the following molecule has highest bond energy?

Q.5 Ans (C) : Greater the number of lone pairs present on the bonded atoms, greater is the repulsive force between them and hence smaller the bond energy.

Molecule C- C

Q 6: The shape of NH3 molecule is :

Q.6 Ans (C) : In NH_3, N is sp^3 hybridised ; N of NH_3 has a lone pair of electrons. The lone pair distorts the normal tetrahedral geometry dye to *lp – bp* interaction to trigonal bipyramidal.

Q 7. A gas occupies a volume of 300 cc at 27°C and 620 mm pressure. The volume of gas at 47°C and 640 mm pressure is :

Q.7 Ans (B): From

$$\frac{p_1 v_1}{T_1} = \frac{p_2 v_2}{T_2}$$

$$\frac{p_{1\,x}\ 640}{(273+47)} = \frac{620 \times 300}{(273+27)}$$

$$v_1 = \frac{620 \times 300 \times 320}{640 \times 300} = 310cc$$

Q 8. A gas cylinder containing cooling gas can withstand a pressure of 14.9 atmosphere. The pressure gauge of cylinder indicates 12 atmosphere at 27°C. Due to sudden fire in the building the temperature starts rising. The temperature at which cylinder explodes is :

Q.8 Ans (B): From Charle's law

,

$$\frac{p_1}{T_1} = \frac{p_2}{T_2}$$

$$\frac{12}{(273+27)} = \frac{14.9}{T_2}$$

$$T_2 = \frac{14.9 \times 300}{12} = 372.5K$$

$$= 372.5 - 273 = 99.5^0\ C$$

Q 9. At a constant volume the specific heat of a gas is 0.075 and its molecular weight is 40. The gas is:

Q.9 Ans (A) : We know that,

Molar heat capacity at constant volume,

C_v = Specific heat at constant volume x Mol. Wt.

= 0.075 x 40 = 3.0 cal

:. $C_p - C_v = R$

or $C_p = R + C_v = 2 + 3 = 5$

Now, $\frac{C_p}{C_v} = \gamma; = \frac{5}{3} = 1.66$

This value shows that the gas is monoatomic

Q 10. The heat of combustion of yellow phosphorous is – 9.91 kJ and of red phosphorous is – 8.78 kJ. The heat of transition of yellow phosphorus to red phosphorus is

Q.10 Ans (D): $P\ (red) + \frac{5}{2} O_2 \rightarrow P_2O_5;\ \Delta H = -9.91$

Subtracting

$$P\ (red) + \frac{5}{2} O_2 - P\ (Yellow) - \frac{5}{2} O_2$$

$$\rightarrow P_2O_5 - P_2O_5$$

P (red) – P (Yellow) = 0;

ΔH = - 8.78+ 9.91 = 1.113

P (red) –⟶ P (Yellow) = ΔH = 1.13

P(Yellow) –⟶ P (red) = ΔH = 1.13

Q 11 The pH value of ordinary water is:

Q.11 Ans (C): pH value of ordinary water is about 5.3 because some CO_2 from atmosphere dissolves in pure water to form H_2CO_3 (carbonic acid), thus making water slightly acidic.

Q 12. Ostwald's dilution law is applicable on:

Q.12 Ans (B) : Ostwald's dilution law is applicable for weak electrolytes because strong electrolytes are 100% ionized at all concentrations while ionization of weak electrolytes increases with increase in dilution.

Q 13. The oxidation number of sulphur in $H_2S_2O_7$

Q.13 Ans (B): Oxidation no. of sulphur in H2S3O7 can be calculated as follows : 2 +2x – 14 = 0

$2x = 14 - 2 = 12$

$x = \frac{12}{2} = 6$

Q 14. In the following chemical reaction:

$$Ag_2O + H_2O + 2e^- \rightarrow 2Ag + 2OH^-$$

Q.14 Ans (C) : In the given reacting, water is being oxidized because it is accepting oxygen from Ag^2 O, while Ag+ is reduced.

$Ag_2O + H_2O + 2e^-$ 2Ag + $2OH^-$

Q 15. The alkali metals form salt-like hydrides by the direct synthesis at elevated temperature. The thermal stability of these hydrides decreases in which of the following orders ?

(a) CsH > RbH > KH > NaH > LiH
(b) KH > NaH > LiH > CsH > RbH
(c) NaH > LiH > KH > RbH > CsH
(d) LiH > NaH > KH > RbH > CsH

Q.15 Ans (D): The stability of alkali metal hydrides decreases from Li to Cs. It is due to the fact that M-H bonds become weaker with increase in size of alkali metals as we move down the group from Li to Cs. Thus the order of stability of hydrides is LiH>NaH>KH>RbH>CsH i.e. option (d) is correct answer.

Q 16. An inorganic compound which on heating first melts, then solidifies and liberates a gas, is

Q.16 Ans (D): $2KC1O_3 \xrightarrow{heat} 2KC1 + 3O_2$

Solid $\xrightarrow{melts}$ solid

Q 17. Nitrolim is:

(a) CaC_2 and graphite
(b) $CaCN_2$ and graphite
(c) $Ca(CN)_2$ and graphite
(d) $CaCN2 + N_2$

Q.17 Ans (B) : Nitrolim is $CaCN_2 + C$. It is used fertilizer since it reacts with H_2O to form NH_3.

$CaCN_2 + 3H_2O \; CaCO_3 + NH_3$

Q 18. Bell metal is an alloy of:

Q.18 Ans (D): Bell mental is an alloy of Cu and Sn.

Q 19. In diamond crystal, each carbon atom is linked with carbon atoms? The number of carbon atoms linked is :

Q.19 Ans (B) : In diamond crystal, carbon atom is in SP^3 hybridised state so each carbon is linked with four other carbons by σ – bond.

Q 20. The number of enantiomers of the compound CH3 CHBrCHBr COOH is :

Q.20 Ans (C): No. of asymmetric carbon =2

No. of enantiomers = 2^2 =4.

Q 21. The most suitable method for removing water traces from ethanol is :

Q.21 Ans (C) : Magnesium reacts only with H_2O to form insoluble $Mg(OH)_2$ and not with alcohol.

$Mg + 2H_2O \rightarrow Mg(OH)_2 \downarrow + H2$

Q 22. Which is used as antiknock in petrol ?

Q.22 Ans (A): Tetraethyl lead (TEL) is used as antiknock in petrol.

Q 23. Glycerol contains

Q.23 Ans (B) : The structure of glycerol is

CH_2OH
|
$CHOH$
|
CH_2OH

Q 24. The vapour pressure of benzene at 30°C is 121.8 mm. By adding 15 g of non-volatile solute in 250g of benzene, its vapour pressure is decreased to 120.2 mm. The molecular weight of solute is :

Q.24 Ans (C): According to Raoult's lae,

$$\frac{p0 - p_s}{p_s} = \frac{w \times M}{m \times W}$$

$$\frac{121.8 - 1200.2}{121.8} = \frac{15}{m} \times \frac{78}{250}$$

$$m = = \frac{15 \times 78 \times 121.8}{250 \times 1.6} = 356.265 \text{ g}$$

Q 25. The colligative property is not represented by :

Q.25 Ans (C): Optical activity is not dependent upon number of molecule of the compound, so it is not a calligative property.

Q 26 Through a solution of $CuSO_4$ a current of 3 amperes was passed for 2 hours. At cathode 3 g of Cu^{2+} ions were discharged. The current efficiency is [At. wt. of Cu = 63.5]

Q.26 Ans (B) : According to law of electrolysis,

Mass deposited (m) = Z i t

or $i = \frac{m \times 96500}{t \times z}$

Here, m = 3g, t = 2 x 60 x 60 = 7200 sec

$z = \frac{Eq.wt}{96500}$; $Eq.wt. = \frac{At.wt}{Oxidation\ number}$

$i = \frac{3 \times 96500 \times 2}{63.5 \times 7200}$

= 1.266A

Efficiency of current

$= \frac{Current\ used}{Total\ current\ passed} \times 100$

$= \frac{1.266}{3} \times 100 = 42.22\%$

Q 27. Which shows electrical conductance?

Q.27 Ans (D) : Though sodium and potassium are metals and show electrical conductance but graphite has more conductance due to presence of - electrons in its crystal lattice, Sodium and potassium have only one electron in its outermost shell. So, inspite of being metal, their conductivity is not so good.

Q 28. For the reaction : the order of the reaction in sunlight is

$H2+Cl2 \rightarrow 2HCl$

Q.28 Ans (A) : The order of all photochemical reactions is zero as it does not depend upon the concentration of reactants.

Q 29. For reaction $a\ x \longrightarrow$ A P, when [A] = 2.2 mM, the rate was found to be 2.4 mMs^{-1}. On reducing concentration of A to half, the rate changes to 0.6 mMs^{-1}. The order of reaction with respect to A is :

Q.29 Ans (B): When the concentration of reactant is reduced to half its initial value, the rate is

Reduced by i = $\frac{2.4}{0.6}$ = 4 tiomes

It means, rate $\propto$ [reactant]^2

So, order of reaction =2

Q 30. A catalyst

Q.30 Ans (B): A catalyst lowers down the activation energy. Greater is decrease in activation energy, higher will be the reaction rate.

Q 31. Carbon and CO gas are used to reduce which of the following pairs of metal oxides for extraction of metals?

Q.31 Ans (D): ZnO + C ¾ $^3/_8$ Zn + CO

FeO + C ¾ $^3/_8$ Fe + CO

In the process of smelting the oxide ore is reduced by carbon and the metal may be obtained in the molten state or as vapours which are condensed. Metals like Zn, Fe, Pb or Sn are obtained by this process.

Q 32. The correct order of solubility in water for He, Ne, Ar, Kr, Xe is

Q.32 Ans (B): As the molecular weight of noble gas atoms increases down the group its polarity increases due to which van-der-waal's force between them in water also increases. So, most soluble gas will Xe and least soluble will be He. So correct order is Xe>Kr>Ar>Ne>He

Q 33. Chlorine acts as a bleaching agent only in presence of:

Q.33 Ans (B): Chlorine acts as bleaching agent only in presence of moisture.

$C1_2 + H_2O \rightarrow 2HC1 + O.$

Q 34. Picric acid is:

Q.34 Ans (A) : Picric acid is *sym*-trinitrophenol

Q 35. The most suitable reagent for the conversion of
$RCH_2OH \rightarrow RCHO$ is :

Q.35 Ans (D): The most suitable reagent for converting alcohol to acetaldehyde is PCC. Other reagent will to acid.

Q 36. $2CH_3COOC_2H_5 \xrightarrow{C_2H_5ONa} CH_3COCH_2COOC_2H_5$

The reaction is called as

Q.36 Ans (A) :

$CH_3- \overset{\overset{O}{\|}}{C} - OC_2H\% + H - CH_2COOC_2H_5$

$CH_3 - \overset{\overset{O}{\|}}{C} - CH_2 - COOC_2H_5$

Self condensation of ester takes place in presence of strong base such as $C_2H_2O^-$. The reaction is known as c1aisen condensation.

Q 37. Acetate ion contains:

Q.37 Ans (A): Acetate ion (CH_3COO^-) has one C - O and one C = O bond.

Q 38. The product formed by the reaction of acetamide with bromine in presence of NaOH is :

Q.38 Ans (D): $CH_3CONH_2 + 2NaOH + Br_2 \rightarrow$

$CH_3 NH_2 + Na_2 CO_3 + 2NaBr + H_2O$

Q 39. The ortho/para directing group among the following is :

Q.39 Ans (D): - NH – CONG2 group is ortho para directing. Nitrogen shares its lone pair with benzene ring and makes this group ortho para directing.

Q 40. Which one of the following is not a condensation polymer ?

Q.40 Ans (D) : Neoprene is an addition polymer of isoprene.

Q 41. Denaturation of proteins leads to loss of its biological activity by

Q.41 Ans (D): Loss of both secondary and tertiary structures

Q 42. Thymine is :

Q.42 Ans (A): Thymine is 5 – methyluacil.

Q 43. Which of the following is a local anaesthetic?

Q.43 Ans (B) : Procaine is the only drug among the given options that is used as a local anaesthetic. Chloramphenicol and penicillin – G both are antibiotics. Diazepam is a sedative.

Q 44. Arsenicals are mainly used for treatment of

Q.44 Ans (C) : Arsenicals are mainly used for the treatment of syphilis.

Q 45. When 8.3 g copper sulphate reacts with excess of potassium iodide then the amount of iodine liberated is:

Q.45 Ans (C) : $2CuSO_4.5H_2O + 4\ KI$

498g

$Cu_2I_2 + 2K_2SO_4 + I_2 + 10H_2O$

498 g of $CuSI_4$ liberate $I_2 = 254g$

8.3 g of $CuSO_4$ liberate $I_2 = 254$ g

$= 4.23$ g

Q 46. Which of the following compounds is not an antacid ?

Q.46 Ans (A) : Phenelzine is an antidepressant, while others are antacids.

Q 47. Which of the following imparts green colour to the burner flame?

Q.47 Ans (A): In the qualitative analysis of BO33- , mixture is heated with conc. H2SO4 and little alcohol when trialkyl borate, R3BO3 or B(OR)3 is formed.

$2BO^{3}{}_{3}\text{-} + 3H_2SO_4 \rightarrow 2H_3BO_3 + 3SO\,^{2-}_{4}$

$H_3BO_3 + 3ROH \rightarrow R_3BO_3 + 3H_2O$

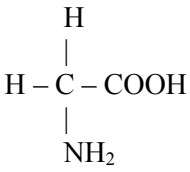
The vapours of trialkyl borate, B(OMe) impart green colour to the burner flame

Q 48. Which of the following is used for inducing sleep?

Q.48 Ans (D) : barbituric acid derivatives are used for inducing sleep

Q 49 Which one of the following statements is correct?

Q.49 Ans (C) : With the exception of glycine all the 19 other common amino acids have a uniquely different functional group on the central tetrahedral alpha carbon.



Glycine

Q 50. Melting points are normally highest for :

Q.50 Ans (D): Although amines as well as amides form intermolecular H-bonding, H-bonding in

Amides is less prominent because of $-\overset{\overset{O}{\|}}{C}-$

Group of $-\overset{\overset{O}{\|}}{C}-NH_2$

1. Find value of A If y = $e^{msin^{-1}x}$ and $(1-x^2)\left(\frac{dy}{dx}\right)^2 = Ay^2$

Ans:- (C)

Solution: Given y = $e^{msin^{-1}x}$

$$\therefore \frac{dy}{dx} = e^{msin^{-1}x}.m.\frac{1}{\sqrt{1-x^2}}$$

$$\left(\frac{dy}{dx}\right)^2 = \left(e^{msin^{-1}x}\right)^2 (m)^2 \left(\frac{1}{\sqrt{1-x^2}}\right)^2 = \left(e^{msin^{-1}x}\right)^2 (m)^2 \left(\frac{1}{1-x^2}\right) = \frac{y^2m^2}{1-x^2}$$

$\therefore (1-x^2)\left(\frac{dy}{dx}\right)^2 = m^2y^2$ Comparing, we write A = m^2

2. If $\int \left(\frac{4e^x-25}{2e^x-5}\right)dx = Ax + Blog|2e^x - 5| + C$

Ans:- (B)

Solution:-

Let I = $\int \left(\frac{4e^x-25}{2e^x-5}\right)dx \Rightarrow \int \left(\frac{10e^x-25-6e^x}{2e^x-5}\right)dx$ $\Rightarrow \int \frac{5(2e^x-5)}{2e^x-5}dx - \int \frac{6e^x}{2e^x-5}dx$

$\Rightarrow 5\int dx - 3\int \frac{2e^x}{2e^x-5}dx$ $\therefore I = 5x - 3log(2e^x - 5) + C$

Comparing we get A = 5 and B = -3

3. find the value $\frac{tan^{-1}\sqrt{3} - sec^{-1}(-2)}{cosec^{-1}(-\sqrt{2}) + cos^{-1}(\frac{-1}{2})}$

Ans:- (B)

Solution:-

Let y = $\frac{tan^{-1}(\sqrt{3}) - sec^{-1}(-2)}{cosec^{-1}(-\sqrt{2}) + cos^{-1}(\frac{-1}{2})}$ $\Rightarrow \frac{tan^{-1}(\sqrt{3}) - \pi + sec^{-1}(2)}{-cosec^{-1}(\sqrt{2}) + \pi - cos^{-1}(\frac{1}{2})}$ $\Rightarrow \frac{tan^{-1}(\sqrt{3}) - \pi + cos^{-1}(\frac{1}{2})}{-sin^{-1}(\frac{1}{\sqrt{2}}) + \pi - cos^{-1}(\frac{1}{2})}$

$= \frac{\frac{\pi}{3} - \pi + \frac{\pi}{3}}{-\frac{\pi}{4} + \pi - \frac{\pi}{3}}$ $= \frac{\frac{2\pi}{3} - \pi}{\pi - \frac{7\pi}{12}} = \frac{-\frac{\pi}{3}}{\frac{5\pi}{12}}$ $= -\frac{\pi}{3} \times \frac{12}{5\pi} = \frac{-4}{5}$

4. find $\frac{dy}{dx}$ $log_{10}\left(\frac{x^2-y^2}{x^2+y^2}\right) = 2$

Ans:- (A)

Solution:-

Given $log_{10}\left(\frac{x^2-y^2}{x^2+y^2}\right) = 2$ $\therefore \frac{x^2-y^2}{x^2+y^2} = 10^2 = 100$ …(by definition of logarithm)

$\therefore x^2 - y^2 = 100x^2 + 100y^2$ $\Rightarrow -101y^2 = 99x^2$

$\therefore 99x^2 + 101y^2 = 0$

Differentiating we get

$(2 \times 99)x + (2 \times 101)y\frac{dy}{dx} = 0$ $\Rightarrow 99x + 101y\frac{dy}{dx} = 0$

$\therefore 101y\frac{dy}{dx} = -99x$ $\Rightarrow \frac{dy}{dx} = \frac{-99x}{101y}$

5. find value $\int_{\frac{-\pi}{2}}^{\frac{\pi}{2}} log\left(\frac{2-\sin x}{2+sinx}\right) dx$

Ans:- (D)

Solution:-

Let I = $\int_{\frac{-\pi}{2}}^{\frac{\pi}{2}} log\left(\frac{2-\sin x}{2+sinx}\right) dx$

Let $f(x) = log\left[\frac{2-\sin x}{2+sinx}\right]$ = log(2 – sin$x$) – log(2 + sin$x$)

$\therefore f(-x) = log\left[\frac{2-\sin(-x)}{2+\sin(-x)}\right] = log\left[\frac{2+\sin(x)}{2-\sin(x)}\right]$

= log(2 + sinx) – log(2 – sinx)

= – [log(2 – sinx) – log(2 + sinx)]

= –f(x)

Hence f(x) is odd function.

$\therefore$ I = 0

6. The degree and order of the differential equation $\left[1+\left(\frac{dy}{dx}\right)^3\right]^{\frac{7}{3}} = 7\left(\frac{d^2y}{dx^2}\right)$

Ans:- (B)

Solution:-

We have $\left[1+\left(\frac{dy}{dx}\right)^3\right]^{\frac{7}{3}} = 7\left(\frac{d^2y}{dx^2}\right)$

Raising both sides to power 3, we get

$\left[1+\left(\frac{dy}{dx}\right)^3\right]^7 = (7)^3\left(\frac{d^2y}{dx^2}\right)^3$

Hence order = 2, degree = 3 $\Rightarrow$ degree and order are respectively 3 and 2

7. The acute angle between the line and the plane as below is

$\vec{r} = \left(\hat{\imath} + 2\hat{\jmath} + \hat{k}\right) + \lambda\left(\hat{\imath} + \hat{\jmath} + \hat{k}\right)$ *and plane* $\vec{r} \cdot \left(2\hat{\imath} - \hat{\jmath} + \hat{k}\right) = 5$

Ans:- (B)

Solution:-

We have line $\vec{r} = \left(\hat{\imath} + 2\hat{\jmath} + \hat{k}\right) + \lambda\left(\hat{\imath} + \hat{\jmath} + \hat{k}\right)$ *and plane* $\vec{r} \cdot \left(2\hat{\imath} - \hat{\jmath} + \hat{k}\right) = 5$

Standard equation of line and plane are $\overline{r} = \overline{a} + \lambda\overline{b}$ and $\overline{r} \cdot \overline{n} = p$ respectively

$\therefore \overline{b} = \hat{\imath} + \hat{\jmath} + \hat{k}$ and $\overline{n} = 2\hat{\imath} - \hat{\jmath} + \hat{k}$

Let θ be the required angle

$\sin\theta = \frac{\overline{b}\cdot\overline{n}}{|\overline{b}|\cdot|\overline{n}|} = \frac{(\hat{\imath}+\hat{\jmath}+\hat{k})\cdot(2\hat{\imath}-\hat{\jmath}+\hat{k})}{|\hat{\imath}+\hat{\jmath}+\hat{k}|\cdot|2\hat{\imath}-\hat{\jmath}+\hat{k}|} = \frac{(1)(2)+(1)(-1)+(1)(1)}{\left(\sqrt{(1)^2+(1)^2+(1)^2}\right)\left(\sqrt{(2)^2+(-1)^2+(1)^2}\right)} = \frac{2-1+1}{(\sqrt{3})(\sqrt{6})}$

$= \frac{2}{(\sqrt{18})} = \frac{2}{3\sqrt{2}} = \frac{\sqrt{2}}{3}$ $\quad \therefore \theta = sin^{-1}\left(\frac{\sqrt{2}}{3}\right)$

8. The area of the region bounded by the curve given below and x-axis is $y = 2x - x^2$

Ans:- (B)

Solution:-

Point of intersection of $y = 2x - x^2$ and x axis i.e. $y = 0$ is

$0 = 2x - x^2 \Rightarrow x(2-x) = 0 \Rightarrow x = 0$ or $x = 2$ When $x = 0$, $y = 0$ and when $x = 2$, $y = 0$

Hence point of intersection are (0, 0) and (2, 0)

Hence required area is

$A = \int_0^2 (2x - x^2)dx$

$A = 2\int_0^2 x\,dx - \int_0^2 x^2 dx = 2\left[\frac{x^2}{2}\right]_0^2 - \left[\frac{x^3}{3}\right]_0^2$

$= \left[x^2 - \frac{x^3}{3}\right]_0^2 = \left[4 - \frac{8}{3}\right] = \frac{4}{3}$ sq. units

9. find f(x) , if $\int \frac{f(x)}{\log(sinx)}dx = \log(\log sinx) + C$

Ans:- (A)

Solution:-

Given $\int \frac{f(x)}{\log(sinx)}dx = \log(\log sinx) + C$

Differentiating both sides w.r.t. x, we get

$\frac{f(x)}{\log(sinx)} = \frac{d}{dx}[\log(\log(\sin x)) \text{ c }]$

$\therefore \frac{f(x)}{\log(sinx)} = \left[\frac{1}{\log(sinx)} \text{ x } \frac{1}{\sin x} \text{ x } \cos x\right] + 0$

$\therefore \frac{f(x)}{\log(sinx)} = \frac{1}{\log(sinx)} + \cot x \therefore f(x) = \cot x$

10. find m+n , If $\overline{a} = \hat{\imath} + \hat{\jmath} - 2\hat{k}$, $\overline{b} = 2\hat{\imath} - \hat{\jmath} + \hat{k}$, and $\overline{c} = 3\hat{\imath} - \hat{k}$ and $\overline{c} = m\,\overline{a} + n\overline{b}$

Ans:- (C)

Solution:-

From given data, we write

$3\hat{\imath} - \hat{k} = m(\hat{\imath} + \hat{\jmath} - 2\hat{k}) + n(2\hat{\imath} - \hat{\jmath} + \hat{k})$

$\therefore 3\hat{\imath} - \hat{k} = m\hat{\imath} + m\hat{\jmath} - 2m\hat{k} + 2n\hat{\imath} - n\hat{\jmath} + n\hat{k}$

$\therefore 3\hat{\imath} - \hat{k} = (m+2n)\hat{\imath} + (m-n)\hat{\jmath} + (n-2m)\hat{k}$

Comparing, we get $m+2n = 3$ …(i)

$m - n = 0$ …(ii)

$n - 2m = -1$ …(iii)

Solving, we get $m = 1$ and $n = 1 \Rightarrow m + n = 2$

11. If sin x is the integrating factor (I.F.) of the following linear differential equation $\frac{dy}{dx} + Py = Q$, $t\square en\ P =$

Ans:- (D)

Solution:-

It is given that Integrating factor of $\frac{dy}{dx} + Py = Q$ is sin x

$\therefore e^{\int P dx} = sinx \qquad \Rightarrow \int P\, dx = \ln(\sin x)$

Differentiating both sides w.r.t. x, we get

$P = \frac{d}{dx}[\ln(\sin x)] \Rightarrow P = \frac{1}{\sin x} \cdot \cos x \Rightarrow P = \cot x$

12. Which of the following equation does not represent a pair of lines?

Ans:- (C)

Solution:-

We will go by options

Option A : $x^2 - x = 0 \Rightarrow x(x-1) = 0 \Rightarrow x = 0$ and $x = 1$ are two lines

Option B : $xy - x = 0 \Rightarrow x(y - 1) = 0 \Rightarrow x = 0$ and $y = 1$ are two lines

Option D : $xy + x + y + 1 \Rightarrow x(y + 1) + 1(y + 1) = 0 \Rightarrow x + 1 = 0$ and $y + 1 = 0$ are two lines

Option C : $y^2 - x + 1 = 0 \Rightarrow y\,2 = x - 1 \Rightarrow$ This is equation of parabola Alternatively this problem can be solved as follows : When $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ represents a pair of straight lines, then

$abc + 2fgh - af^2 - bg^2 - ch^2 = 0$ Students may check all options by using this formula

13. if p : Every square is a rectangle and q : Every rhombus is a kite, then truth values of

Ans:- (D)

Solution:-

p : Every square is a rectangle : Truth value of statement p is T

q : Every rhombus is a kite : Truth value of statement q is T

$\therefore p \rightarrow q \equiv T \rightarrow T \equiv T$

$p \leftrightarrow q \equiv T \leftrightarrow T \equiv T$

14. If G(g), H(h) and are centroid, orthocenter and circumcenter of a triangle and xc+yh+zg=0, then (x, y, z) =

Ans:- (B)

Solution:-

We know that centroid, orthocenter and circumcentre of a triangle are collinear and distance between centroid and orthocenter is twice the distance between centroid and circumcentre.

H : Orthocentre

G : Centroid

C : Circumcentre

GH = 2 GC

Thus G divides segment HC in the ratio 2 : 1

$\therefore \overline{g} = \frac{2\overline{c} + \overline{h}}{2+1} \Rightarrow 3\overline{g} = 2\overline{c} + \overline{h}$ i.e. $2\overline{c} + \overline{h} - 3\overline{g} = 0$

We have $x\overline{c} + y\overline{h} + z\overline{g} = 0$ (given)

Comparing, we get x = 2, y = 1, z = –3

15. Which of the following quantified statements is true?
Ans:- (A)
Solution:-

By fundamental concepts about real numbers, we find that only
option (A) ***"The square of every real number is positive"*** is correct.

16. The general solution of the equation
Ans:- (C) Option 3
Solution:-

$\tan^2 x = 1$
$\therefore \tan x = \pm 1 \Rightarrow \tan x = 1$ or $\tan x = -1$
$\therefore \tan x = \frac{4}{\pi}$ or $\tan x = \frac{3\pi}{4}$
$\therefore x = \frac{n\pi}{4}$

17. Direction ratios of the line which is perpendicular to the lines with direction ratios -1, 2, 2 and 0, 2, 1 are
Ans:- (B)
Solution:-

Let direction ratios of the required line be a, b, c
$\therefore -1a + 2b + 2c = 0$
$0a + 2b + 1c = 0$
$\therefore \frac{a}{\begin{vmatrix} 2 & 2 \\ 2 & 1 \end{vmatrix}} = \frac{-b}{\begin{vmatrix} -1 & 2 \\ 0 & 1 \end{vmatrix}} = \frac{c}{\begin{vmatrix} -1 & 2 \\ 0 & 2 \end{vmatrix}}$
$\therefore \frac{a}{2-4} = \frac{-b}{-1-0} = \frac{c}{-2-0} \Rightarrow \frac{a}{-2} = \frac{b}{1} = \frac{c}{-2} \Rightarrow \frac{a}{2} = \frac{b}{-1} = \frac{c}{2}$
Hence direction ratios of the required line are 2, –1, 2

18. if matrix A is as follows, and AX=1 , then x=? $A = \begin{bmatrix} 1 & 2 \\ 4 & 3 \end{bmatrix}$
Ans: C Option 3
Solution:-

Given : Ax = I $\Rightarrow A^{-1}Ax = A^{-1}I$ $\Rightarrow Ix = A^{-1}$ $\therefore x = A^{-1}$
We have $A = \begin{bmatrix} 1 & 2 \\ 4 & 3 \end{bmatrix} \Rightarrow |A| = 3 - 8 = -5$ and $adj\ A = \begin{bmatrix} 3 & -2 \\ -4 & 1 \end{bmatrix}$
$\therefore A^{-1} = x = -\frac{1}{5}\begin{bmatrix} 3 & -2 \\ -4 & 1 \end{bmatrix}$ $\therefore x = \frac{1}{5}\begin{bmatrix} -3 & 2 \\ 4 & -1 \end{bmatrix}$

19. If $\overline{a} = \hat{\imath} + \hat{\jmath} + \hat{k}$, $\overline{b} = 2\hat{\imath} + \lambda\hat{\jmath} + \hat{k}$ and $\overline{c} = \hat{\imath} - \hat{\jmath} + 4\hat{k}$ and $\overline{a} \cdot (\overline{b} \times \overline{c}) = 10$ then λ is equal to
Ans: A
Solution:-

$$\overline{a} \cdot (\overline{b} \times \overline{c}) = \begin{vmatrix} 1 & 1 & 1 \\ 2 & \lambda & 1 \\ 1 & -1 & 4 \end{vmatrix} = 10$$

$\therefore 1(4\lambda + 1) - 1(8 - 1) + 1(-2-\lambda) = 10$
$\therefore 4\lambda + 1 - 7 - 2 - \lambda = 10$ $\Rightarrow 3\lambda - 9 + 1 = 10$ $\Rightarrow 3\lambda = 18$ $\Rightarrow \lambda = 6$

20. If r.v. X ~ B (n=5, p = $\frac{1}{3}$) then P (2 < x < 4) = _____

Ans:- (B)

Solution:-

We have, n = 5, p = $\frac{1}{3}$ $\Rightarrow$ q = 1 – p = 1 - $\frac{1}{3}$ = $\frac{2}{3}$

P (2 < x < 4) = P(x = 3)

$= 5_{C_3} \left(\frac{1}{3}\right)^3 \left(\frac{2}{3}\right)^2 = \frac{5 \times 4}{2} \times \frac{1}{27} \times \frac{4}{9} = \frac{40}{243}$

21. If f(x) is as $f(x) = cos^{-1}\left[\frac{1-(logx)^2}{1+(logx)^2}\right]$ then $f'(e)$ =

Ans:- (d)

Solution:-

Let $1 + (\log x)^2 = u$ $\Rightarrow$ $1 - (\log x)^2 = 2 - u$ $\Rightarrow$ $f(u) = \cos^{-1}\left[\frac{2-u}{u}\right] = \cos^{-1}\left(\frac{2}{u} - 1\right)$

$\Rightarrow \left[\frac{\left(\frac{2}{u^2}\right)}{\sqrt{1-\left(\frac{2}{u}-1\right)^2}}\right] = \frac{1}{u\sqrt{u-1}}$ $\Rightarrow f'(x) = \frac{1}{(1+(logx)^2)\sqrt{(logx)^2}}$ $\Rightarrow \frac{1}{logx(1+(logx)^2)}$

$f'(e) = \frac{1}{loge(1+(loge)^2)} = \frac{1}{2}$

22. The order of the differential equation of all circles whose radius is 4

Ans:- (B)

Solution:-

Equation of family of circles whose radius is 4 is

$(x-a)^2 + (y-b)^2 = 16$ -------(i)

(where a and b are arbitrary constant)

Differentiating we get:

$2(x-a) + 2(y-b)y_1$ ------(ii) $\left(y_1 = \frac{dy}{dx}\right)$

Again Differentiating we get:

$1 + y_1 \cdot y_1 + (y-b)y_2 = 0$ $\left(y_2 = \frac{d^2y}{dx^2}\right)$

$\Rightarrow 1 + y_1^2 + (y-b)\,y_2 = 0$

$\Rightarrow (y-b)\,y_2 = -(1+y_1^2)$

$\Rightarrow y - b = -\frac{(1+y_1^2)}{y_2}$ ---------(iii)

from (ii) we get $x - a = -(y-b)y_1$

$\therefore$ from (i) we get:

$(y-b)^2 y_1^2 + (y-b)^2 = 16$

$\Rightarrow (y-b)^2 - (1+y_1^2) = 16$ (from (iii))

$\Rightarrow (1+y_1^2)^3 = 16y_2^2$

$\left[1 + \left(\frac{dy}{dx}\right)^2\right]^3 = 16\left[\frac{d^2y}{dx^2}\right]^2$

$\therefore$ Order = 2 & degree = 2

23. If A is matrix as given below then find value of x $A = \begin{bmatrix} x & 1 \\ 1 & 0 \end{bmatrix}$ $and\ A = A^{-1}$

Ans:- (a)

Solution:-

$$A = \begin{bmatrix} x & 1 \\ 1 & 0 \end{bmatrix} \Rightarrow |A| = 0 - 1 = -1$$

$$\therefore A^{-1} = -1\begin{bmatrix} 0 & -1 \\ -1 & x \end{bmatrix} \Rightarrow A = A^{-1} \Rightarrow x = 0$$

24. It is observed that 25% cases of the child labour reported to police station are solved. If 6 new cases are reported then the probability of at least 5 of them will be solved is

Ans: (D) $\frac{19}{4096}$

25. for a G.P. $S_n = \left(\frac{4^n - 3^n}{3^n}\right)$ then t_2

Ans:- (D)

Solution:-

$S_n = \left(\frac{4^n - 3^n}{3^n}\right)$ $S_1 = \frac{4-3}{3}$ $S_1 = \frac{1}{3}$

$S_2 = \frac{4^2-3^2}{3^2} = \frac{16-9}{9} = \frac{7}{9}$ $\therefore t_2 = s_2 - s_1 = \frac{7}{9} - \frac{1}{3} = \frac{7-3}{9} = \frac{4}{9}$

26. The general solution of the following equation is $x\frac{dy}{dx} = y - xtan\left(\frac{y}{x}\right)$

Ans:- (C)

Solution:-

Given : $x\frac{dy}{dx} = y - xtan\left(\frac{y}{x}\right)$ $\Rightarrow \frac{dy}{dx} = \frac{y}{x} - tan\left(\frac{y}{x}\right)$ ----(i)

Put $\frac{y}{x} = v$ $\Rightarrow y = xv = \frac{dy}{dx} = v + x\frac{dv}{dx}$

$\Rightarrow x\frac{dv}{dx} + v = v - \tan v$ (from (i))

$\Rightarrow x\frac{dv}{dx} = -\tan v$

27. The statement pattern $(p \wedge q) \wedge [\sim r \vee (p \wedge q)] \vee (\sim p \wedge q)$ is equivalent to

Ans:- (B)

Solution:-

p	q	r	$\sim r$	$\sim p$	$p \wedge q$	$\sim p \wedge q$	$\sim r \vee (p \wedge q)$	$(p \wedge q) \wedge [\sim r \vee (p \wedge q)]$	$(p \wedge q) \wedge [\sim r \vee (p \wedge q)] \vee (\sim p \wedge q)$
T	T	T	F	F	T	F	T	T	T
T	T	F	T	F	T	F	T	T	T
T	F	T	F	F	F	F	F	F	F
T	F	F	T	F	F	F	T	F	F
F	T	T	F	T	F	T	F	F	T
F	T	F	T	T	F	T	T	F	T
F	F	T	F	T	F	F	F	F	F
F	F	F	T	T	F	F	T	F	F

$\therefore (p \wedge q) \wedge [\sim r \vee (p \wedge q)] \vee (\sim p \wedge q) = q$

28. A bag contains 6 white ball and 4 black balls. Two balls are drawn at random. The probability that they are of same color is

Ans:- (C)

Solution:-

Total No of balls = 10

No of ways of drawing 2 balls out of 10 = $10_{C_2} = 45$

No of ways of drawing 2 white balls out of 6 = $6_{C_2} = 15$

No of ways of drawing 2 black balls out of 4 = $4_{C_2} = 6$

$\therefore$ required probability = $\frac{15+6}{45} = \frac{21}{45} = \frac{7}{15}$

29. solve the following $\int \frac{cosx+xsinx}{x^2+xcosx}\, dx = ..$

Ans:- (B)

Solution:-

Let $I = \int \frac{cosx+xsinx}{x^2+xcosx}\, dx$ => $I = \int \frac{(x+cosx)-x(1-sinx)}{x(x+cosx)}\, dx$ => $I = \int \left[\frac{1}{x} - \frac{(1-sinx)}{(x+cosx)}\right] dx$

Put f(x) = x+cosx => f '(x) = 1 – sinx => $I = \int \left[\frac{1}{x} - \frac{f'(x)}{f(x)}\right] dx$ => *log |x| - log | f(x) |+ C*

$= log\left|\frac{x}{x+cosx}\right| + C$

30. find the value of *f[g(x)]* if the values of the functions are *f(x) = 3x – 2 and g(x) = x^2*

Ans:- (A)

Solution:-

Given f(x) = 3x – 2 and g(x) = x^2

⇨ *f[g(x)] = 3(x)^2 – 2 = 3x^2 – 2*

31. Which of the following is not equivalent to p → q

Ans:- (C)

Solution:-

" q only if p " is not equivalent " p → q "

32. If a,b,c and k are constants then the value of following equation depends on

$\int_{-3}^{3}(ax^5 + bx^3 + cx + k)dx$

Ans:- (B)

Solution:-

$\int_{-3}^{3}(ax^5 + bx^3 + cx + k)dx = \left[\frac{ax^6}{6} + \frac{bx^4}{4} + \frac{cx^2}{2} + kx\right]_{-3}^{3}$

$= \left[\frac{a(3)^6}{6} + \frac{b(3)^4}{4} + \frac{c(3)^2}{2} + k(3)\right] - \left[\frac{a(-3)^6}{6} + \frac{b(-3)^4}{4} + \frac{c(-3)^2}{2} + k(-3)\right]$

= 6k

$\therefore$ given integral depends only on k

33. If A is non singular matrix such that (A-2I).(A-4I)=0 then $A + 8A^{-1} =$

Ans:- (D)

Solution:-

As per matrix multiplication $A + 8A^{-1} = 6I$

34. If G(3-5,r) are the centroid of Triangle ABC where A(7,-8,1), B(p, q, 5) and c(q+1, 5p ,0) are the vertices of the triangle then the values of p,q,r are respectively

Ans:- (D)

Solution:-

Here $\frac{7+p+q+1}{3} = 3 \Rightarrow$ p + q = 1 ……(i)

$\frac{-8+q+5p}{3} = -5 \Rightarrow$ 5p + q = -7 …….(ii)

And $\frac{1+5+0}{3} = r \Rightarrow$ r = 2

Substract (ii) from (i) we get:

p + q – 5p – q = 1 + 7

$\Rightarrow$ -4p = 8 $\Rightarrow$ p = -2

From (1) we get

-2+q = 1 $\Rightarrow$ q = 3

$\therefore$ p = -2 , q = 3 , & r = 2

35. Find the value $\int \frac{1}{(x^2+1)^2} dx$

Ans:- (B)

Solution:-

Let I = $\int \frac{1}{(x^2+1)^2} dx$

Put $x = tan\theta \Rightarrow dx = sec^2\theta \, d\theta$

$\Rightarrow$ I = $\int \frac{sec^2\theta \, d\theta}{(tan^2\theta + 1)^2} = \int \frac{sec^2\theta \, d\theta}{Sec^4\theta}$

$\Rightarrow$ I = $\int cos^2 \theta \, d\theta = \frac{1}{2}\int (cos2\theta + 1) d\theta$

$\Rightarrow$ I = $\frac{1}{2} sin2\theta + \frac{\theta}{2} + c$ ……(i)

Since tan $\theta = x$

$\Rightarrow$ sin $\theta = \frac{x}{\sqrt{(1+x^2}}$ & cos $\theta = \frac{1}{\sqrt{(1+x^2}}$

$\Rightarrow$ sin2θ = 2sin θ cos $\theta = \frac{2x}{(1+x^2)}$

$\therefore$ I = $\frac{1}{2}\frac{x}{(1+x^2)} + \frac{1}{2} tan^{-1}x + C$

36. If $\theta = \frac{17\pi}{3}$ then $tan\theta$ - $cot\theta$=

Ans:- (D)

Solution:-

Since $\theta = \frac{17\pi}{3} = 6\pi - \frac{\pi}{3}$

$\therefore tan\theta - cot\theta = tan\left(6\pi - \frac{\pi}{3}\right) - cot\left(6\pi - \frac{\pi}{3}\right)$

$= - tan\frac{\pi}{3} + cot\frac{\pi}{3}$ $= -\sqrt{3} + \frac{1}{\sqrt{3}} = \frac{-3+1}{\sqrt{3}} = = \frac{-2}{\sqrt{3}}$

37. Derivative of following equation with respect to x is $log_e^2(logx) =$

Ans:- (C)

Solution:-

Let y = $log_e^2(logx)$ $\Rightarrow \frac{\log(logx)}{log_e^2} = \frac{\log(logx)}{2}$

$\Rightarrow \frac{dy}{dx} = \frac{1}{2} \cdot \frac{1}{\log x} \frac{d}{dx}(\log x)$ $\Rightarrow \frac{1}{2\log x} \cdot \frac{1}{x} = \frac{1}{2x\log x} = \frac{1}{xlogx^2}$

38. In triangle ABC, with usual notation, Identify the type of triangle if the following equation is given cos A = $\frac{\sin B}{Sin\ C}$

Ans:- (D)

Solution:-

Since cos A = $\frac{\sin B}{Sin\ C}$

$\Rightarrow$ cos A sin C = sin B

$\Rightarrow$ cos A sin C = sin$(\pi - (A + C))$ (Since A+B+C = π)

$\Rightarrow$ cos A sin C = sin$(A + C)$

$\Rightarrow$ cos A sin C = sin A cos C + cos A sin C

$\Rightarrow$ sin A cos C = 0

$\Rightarrow$Either sin A = 0 or cos C = 0

For sin A = 0 A = 0^0 (not possible)

For cos C = 0 C = 90^0

$\therefore \Delta ABC$ *is right angled triangle*

39. In G.P, find mth term if *(m + n)th term is p and (m – n)th term is q*

Ans:- (B)

Solution:-

Let a is the first term & r is the common ration

$\therefore p = ar^{m+n-1}$ & $q = ar^{m-n-1}$

$\Rightarrow pq = a^2 r^{m+n-1} r^{m-n-1}$ $\Rightarrow pq = a^2 r^{2m-2} = (ar^{m-1})^2$

$\Rightarrow \sqrt{pq} = ar^{m-1}$ = mth term

40. The equation of normal to the given curve as given $y = log_e^x$ at point P(1, 0) is

Ans:- (D)

Solution:-

As per the equation normal to the given curve

$y = log_e^x$ point P(1, 0) is $\boldsymbol{x + y = 1}$

41. Which of the following equation has no solution

Ans:- (B)

Solution:-

$cos\theta = \sqrt{2}$ *has no solution, since value of* $cos\theta$ *lies in [-1 , 1]*

42. If the length of the transverse axis and and the lats return of the hyperbola are 6 and 8/3 respectively, then the equation of the hyperbola is

Ans:- (b)

Solution:-

For $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ Length of traverse axis is $= 2a = 6 \Rightarrow a = 3$

and length of latus rectum $= \frac{2b^2}{a} = \frac{8}{3} \Rightarrow b^2 = 4$

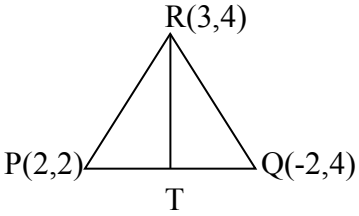
$\therefore$ equation of hyperbola is : $\frac{x^2}{9} - \frac{y^2}{4} = 1 \quad \Rightarrow 4x^2 - 9y^2 = 36$

43. If P(2,2), Q(-2,4) and R(3,4) are the vertices of the triangle PQR, then the equation of the median through vertex R is

Ans:- (B)

Solution:-

From figure it is clear that T is the midpoint of PQ



$\therefore$ co-ordinates of T $= \left[\frac{2-2}{2}, \frac{2+4}{2}\right] = (0, 3)$

Equation of RT is $(y - 4) = \left[\frac{3-4}{0-3}\right](x - 3)$

or $(y - 4) = \frac{1}{3}(x - 3)$ or $3y - 12 = x - 3$

or $x - 3y + 9 = 0$

44. If the line passing through the points P(6, -1, 2), Q(8, -7, 2λ) and R(5, 2, 4) then value of λ is

Ans:- (C)

Solution:-

Here the given three points P(6, -1, 2), Q(8, -7, 2λ) and R(5, 2, 4) are collinear.

We know that if three points (x_1, y_1, z_1), (x_2, y_2, z_2) and (x_3, y_3, z_3) are collinear then

$\frac{x_1-x_2}{x_2-x_3} = \frac{y_1-y_2}{y_2-y_3} = \frac{z_1-z_2}{z_2-z_3}$ $\quad \therefore \frac{6-8}{8-5} = \frac{-1+7}{-7-2} = \frac{2-2\lambda}{2\lambda-4} \Rightarrow \frac{-2}{3} = \frac{2-2\lambda}{2\lambda-4} \Rightarrow -4\lambda + 8 = 6 - 6\lambda$

$\Rightarrow 2\lambda = -2 \quad \Rightarrow \lambda = -1$

45. The equivalent form of statement given $\sim (p \rightarrow \sim q)$

Ans:- (A)

Solution:-

$\sim (p \rightarrow \sim q) = p \wedge \sim (\sim q) = p \wedge q$

46. If $\{x \varepsilon R : x^2 - 5|x| + 6 = 0\}$ then *n(A)* =

Ans:- (D)

Solution:-

$x^2 - 5|x| + 6 = 0$ if $x < 0$, then $|x| = -x$

$\therefore x^2 + 5x + 6 = 0 \Rightarrow x^2 + 3x + 2x + 6 = 0$

$x(x + 3) + 2(x + 3) = 0 \Rightarrow (x + 3)(x + 2) = 0$

$\Rightarrow x = -3, -2$

If $x > 0$, then $|x| = x$

$\therefore x^2 - 5x + 6 = 0 \Rightarrow x^2 - 3x - 2x + 6 = 0$

$x(x - 3) - 2(x - 3) = 0 \Rightarrow (x - 3)(x - 2) = 0$

$\Rightarrow x = 3, 2$

$\therefore n(A) = 4$

47. If the function $f(x) = \frac{\log(1+ax) - \log(1-bx)}{x}$ and $x \neq 0$ is continuous at $x = 0$ then *f(0)* is

Ans:- (B)

Solution:-

$$\lim_{x \to 0} f(x) = \lim_{x \to 0} \frac{\log(1+ax) - \log(1-bx)}{x} \left(\frac{0}{0}\right)$$

$$= \lim_{x \to 0} \frac{\frac{a}{1+ax} + \frac{a}{1+bx}}{1} \quad (Using\ L'Hospital\ Tule)$$

$$= \frac{a}{1+0} + \frac{a}{1-0} = a + b$$

Since *f(x) is continuous at* $x = 0$

Since f(0) $= = \lim_{x \to \infty} f(x) = a + b$

48. *find the max value of f(x) if* $f(x) = 3x^3 - 9x^2 - 27x + 15$

Ans:- (B)

Solution:-

$f(x) = 3x3 - 9x2 - 27x + 15 \Rightarrow f'(x) = 9x^2 - 18x - 27.$

For maxima or minima: $f'(x) = 0 \Rightarrow 9x^2 - 18x - 27 = 0. \Rightarrow x^2 - 2x - 3 = 0$

$x^2 - 3x + x - 3 = 0 \Rightarrow x(x-3) + 1(x-3) = 0 \Rightarrow x = -1, 3.$

$f''(x) = 18x - 18. \Rightarrow f''(-1) = -18 - 18 = -36 < 0 \Rightarrow f''(3) = 18(3) - 18 = 36 > 0$

$\therefore f(x)$ *has maximum value at* $x = -1$. & *max. value* $= 3(-1)^3 - 9(-1)^2 - 27(-1) + 15$

$= -3 - 9 + 27 + 15 = 30.$

49. The value of $tan^{-1}\left(\frac{1}{3}\right) + tan^{-1}\left(\frac{1}{5}\right) + tan^{-1}\left(\frac{1}{7}\right) + \ldots\ldots$

Ans:- (B)

Solution:-

Since $tan^{-1}x + tan^{-1}y = tan^{-1}\left(\frac{x+y}{1-xy}\right)$, *if xy<1*

$\therefore tan^{-1}\left(\frac{1}{3}\right) + tan^{-1}\left(\frac{1}{5}\right) + tan^{-1}\left(\frac{1}{7}\right) + tan^{-1}\left(\frac{1}{8}\right)$

$\Rightarrow tan^{-1}\left[\frac{\frac{1}{3}+\frac{1}{5}}{1-\frac{1}{15}}\right] + tan^{-1}\left[\frac{\frac{1}{7}+\frac{1}{8}}{1-\frac{1}{56}}\right]$

$\Rightarrow tan^{-1}\left[\frac{\frac{8}{15}}{\frac{14}{15}}\right] + tan^{-1}\left[\frac{\frac{15}{56}}{\frac{55}{56}}\right] \qquad \Rightarrow tan^{-1}\frac{8}{14} + tan^{-1}\frac{15}{55}$

$\Rightarrow tan^{-1}\frac{4}{7} + tan^{-1}\frac{3}{11} \qquad \Rightarrow tan^{-1}\frac{65}{65} = tan^{-1}(1) = \frac{\pi}{4}$

50. The following boolean expression is equivalent to ~ (p ∨ q) ∨ (~p ∧ q)

Ans:- (D)

Solution:-

~ (p ∨ q) ∨ (~p ∧ q) ≡ ~p