JEE Main 2019

Question Paper with Answer



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JEE Main 2019 Question Paper with Answer
08 Jan 2019 : Shift 1 : Paper 1

Physics

1. A magnet of total magnetic moment $10^{-2}\hat{i}\,\mathrm{A}-\mathrm{m}^2$ is placed in a time varying magnetic field, $\mathrm{B}_{i(\mathrm{cosent})}^{\mathrm{A}}$ where B=1 Tesla and ω=0.125 rad/s . The work done for reversing the direction of the magnetic moment at t=1 second, is :

1. 0.007 J
2. 0.01 J
3. 0.028 J
4. 0.014 J

Correct: 4

2. A piece of wood of mass 0.03 kg is dropped from the top of a 100 m height building. At the same time, a bullet of mass 0.02 kg is fired vertically upward, with a velocity $100\mathrm{ms}^{-1}$, from the ground. The bullet gets embedded in the wood. Then the maximum height to which the combined system reaches above the top of the building before falling below is : ($g = 10\mathrm{ms}^{-2}$)
1. 10 m
2. 30 m
3. 20 m
4. 40 m

Correct: 4

3. A uniform metallic wire has a resistance of 18Ω and is bent into an equilateral triangle. Then, the resistance between any two vertices of the triangle is
1. 4 Ω
2. 2 Ω
3. 8 Ω
4. 12 Ω

Correct: 1

4. A plano convex lens of refractive index μ_1 and focal length f_1 is kept in contact with another plano concave lens of refractive index μ_2 and focal length f_2. If the radius of curvature of their spherical faces is R each and $f_1 = 2f_2$ then μ_1 and μ_2 are
related as:
1. $3\mu_2 - 2\mu_1 = 1$
2. $\mu_1 + \mu_2 = 3$
3. $2\mu_1 - \mu_2 = 1$
4. $2\mu_2 - \mu_1 = 1$

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Correct: 3

5. A TV transmission tower has a height of 140 m and the height of the receiving antenna is 40 m. What is the maximum distance upto which signals can be broadcasted from this tower in LOS(Line of Sight) mode ? (Given : radius of earth = $6.4 \times 10^6 \mathrm{m}$.
1. 65 km
2. 48 km
3. 40 km
4. 80 km

Correct: 1

6. The density of a material in SI units is $128 \mathrm{kgm}^{-3}$
In certain units in which the unit of length is 25 cm and the unit of mass is 50 g, the numerical value of density of the material is :

1. 640
2. 16
3. 40
4. 410

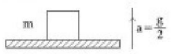
Correct: 3

7. A solid metal cube of edge length 2 cm is moving in a positive y-direction at a constant speed of 6 m/s. There is a uniform magnetic field of 0.1 T in the positive z-direction. The potential difference between the two faces of the cube perpendicular to the x-axis, is :

1. 2 mV
2. 6 mV
3. 1 mV
4. 12 mV

Correct: 4

8. A block of mass m is kept on a platform which starts from rest with constant acceleration g/2 upward, as shown in fig. Work done by normal reaction on block in time t is :



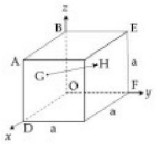
1. $\frac{mg^2t^2}{8}$
2. 0
3. $\frac{3mg^2t^2}{8}$
4. $-\frac{mg^2t^2}{8}$

Correct: 3

9. In the cube of side 'a' shown in the figure, the vector from the central point of the face ABOD to the central point of the face BEFO will be :

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1. $\frac{1}{2}a\begin{pmatrix} n & \\ j & -\hat{k} \end{pmatrix}$
2. $\frac{1}{2}a\begin{pmatrix} n & \\ j & -i \end{pmatrix}$
3. $\frac{1}{2}a(\hat{k}-\hat{i})$
4. $\frac{1}{2}a\begin{pmatrix} \hat{i}-\hat{k} & \end{pmatrix}$

Correct: 2

10. A train moves towards a stationary observer with speed 34 m/s. The train sounds a whistle and its frequency registered by the observer is f1. If the speed of the train is reduced to 17 m/s, the frequency registered is f. If speed of sound
is 340 m/s, then the ratio f1/f2 is

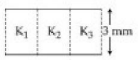
1. 20/19
2. 18/17
3. 21/20
4. 19/18

Correct: 4

11. An insulating thin rod of length 1 has a linear charge density $\rho(x)=\rho_0\frac{x}{l}$, on it. The rod is rotated about an axis passing through the origin (x=0) and perpendicular to the rod. If the rod makes n rotations per second, then the time averaged magnetic moment of the rod is :
1. $\pi \mathrm{n}\rho l^3$
2. $\frac{\pi}{3}n\rho l^3$
3. $\frac{\pi}{4}\mathbf{n}\rho l^3$
4. $\mathrm{n}\rho l^3$

Correct: 3

12. A parallel plate capacitor is of area $6\mathrm{cm}^2$ and a separation 3 mm. The gap is filled with three dielectric materials of equal thickness (see figure) with dielectric constants $\mathrm{K}_1=10, \mathrm{K}_2=12$ and $\mathrm{K}_3=14$ .The dielectric constant of a material which when fully inserted in above capacitor, gives same capacitance would be :



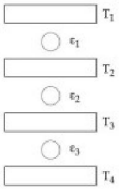
1. 36
2. 12
3. 4
4. 14

Correct: 2

13. Three Carnot engines operate in series between a heat source at a temperatureT_1 and a heat sink at

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temperature T. (see figure). There are two other reservoirs at temperatureT_2 and T_3 as shown, with $\mathrm{T}_1 > \mathrm{T}_2 > \mathrm{T}_3 > \mathrm{T}_4$ The three engines are equally efficient if :



1. $\mathrm{T}_2 = \left(\mathrm{T}_1^2\mathrm{T}_4\right)^{1/3}; \mathrm{T}_3 = \left(\mathrm{T}_1\mathrm{T}_4^2\right)^{1/3}$
2. $\mathrm{T}_2 = \left(\mathrm{T}_1\mathrm{T}_4\right)^{1/2}; \mathrm{T}_3 = \left(\mathrm{T}_1^2\mathrm{T}_4\right)^{1/3}$
3. $\mathrm{T}_2 = \left(\mathrm{T}_1^3\mathrm{T}_4\right)^{1/4}; \mathrm{T}_3 = \left(\mathrm{T}_1\mathrm{T}_4^3\right)^{1/4}$
4. $\mathrm{T}_2 = \left(\mathrm{T}_1\mathrm{T}_4^2\right)^{1/3}; \mathrm{T}_3 = \left(\mathrm{T}_1^2\mathrm{T}_4\right)^{1/3}$

Correct: 1

14. A satellite is moving with a constant speed v in circular orbit around the earth. An object of mass 'm' is ejected from the satellite such that it just escapes from the gravitational pull of the earth. At the time of ejection, the kinetic energy of the object is : :

1. $\frac{2}{1}mv^2$
2. $2\mathrm{m}v^2$
3. $\frac{2}{3}mv^2$
4. $\mathrm{m}v^2$

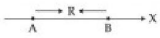
Correct: 4

15. A heat source at $\mathrm{T} = 10^3$ K is connected to another heat reservoir at $\mathrm{T} = 10^2$ by a copper slab which is 1 m thick. Given that the thermal conductivity of copper is $0.1\mathrm{WK}^{-1}\mathrm{m}^{-1}$, the energy flux through it in the steady state is

1. $120\mathrm{Wm}^{-2}$
2. $90\mathrm{Wm}^{-2}$
3. $200\mathrm{Wm}^{-2}$
4. $65\mathrm{Wm}^{-2}$

Correct: 2

16. Two electric dipoles, A, B with respective dipole moments $\vec{\mathrm{d}}_\mathrm{A} = -4\mathrm{qa}\hat{i}$ and $\vec{\mathrm{d}}_\mathrm{B} = -2\mathrm{qa}\hat{i}$ are placed on the x-axis with a separation R, as shown in the figure The distance from Aat which both of them produce the same potential is



1. $\frac{R}{\sqrt{2}-1}$
2. $\frac{R}{\sqrt{2}+1}$
3. $\frac{\sqrt{2}\mathrm{R}}{\sqrt{2}+1}$
4. $\frac{\sqrt{2}\mathrm{R}}{\sqrt{2}-1}$

Correct: 3

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17. To mop-clean a floor, a cleaning machine presses a circular mop of radius R vertically down with a total force F and rotates it with a constant angular speed about its axis. If the force F is distributed uniformly over the mop and if coefficient of friction between the mop and the floor is μ the torque, applied by the machine
on the mop is:
1. $\mu \mathrm{FR}/2$
2. $\mu . \mathrm{FR}/6$
3. $\mu \mathrm{FR}/3$
4. $\frac{2}{3}\mu \mathrm{FR}$

Correct: 4

18. A homogeneous solid cylindrical roller of radius R and mass Mis pulled on a cricket pitch by a horizontal force. Assuming rolling without slipping, angular acceleration of the cylinder is :
1. $\frac{\mathrm{F}}{2\mathrm{mR}}$
2. $\frac{F}{3mR}$
3. $\frac{2\mathrm{F}}{3\mathrm{mR}}$
4. $\frac{3\mathrm{F}}{2\mathrm{mR}}$

Correct: 3

19. Two guns A and B can fire bullets at speeds 1 km/s and 2 km/s respectively. From a point on a horizontal ground, they are fired in all possible directions. The ratio of maximum areas covered by the bullets fired by the two guns, on the ground is
1. 1:2
2. 1:16
3. 1:4
4. 1:8

Correct: 2

20.In an electron microscope, the resolution that can be achieved is of the order of the wavelength of electrons used. To resolve a width of $7.5 \times 10^{-12} \mathrm{m}$, the minimum
electron energy required is close to
1. 25 keV
2. 100 keV
3. 1 keV
4. 500 keV

Correct: 1

21. If the magnetic field of a plane electromagnetic wave is given by (The speed of light=$3 \times 10^{8} \mathrm{m/s}$)
$\mathrm{B} = 100 \times 10^{-6} \sin\left[2\pi \times 2 \times 10^{15}\left(\mathrm{t} - \frac{x}{\mathrm{c}}\right)\right]$ then the maximum electric field associated with it is

1. $4.5 \times 10^{4} \mathrm{N/C}$
2. $4 \times 10^{4} \mathrm{N/C}$
3. $6 \times 10^{4} \mathrm{N/C}$

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4. $3 \times 10^4 \mathrm{N/C}$

Correct: 4

22. A charge Q is distributed over three concentric spherical shells of radii a, b, c (a < b < c) such that their surface charge densities are equal to one another. The total potential at a point at distance r from their common centre, where r

1. 11/12 L
2. 5/12 L
3. 11/24 L
4. 13/24 L

Correct: 4

24. In a Young's double slit experiment with slit separation 0.1 mm, one observes a bright fringe at angle 1/40 rad by using light of wavelength λ_1 . When the light of wavelength λ_2 is used a bright fringe is seen at the same angle in the same set up. Given that λ_1 and λ_2 are in visible range (380 nm to 740 nm), their values are

1. 400 nm, 500 nm
2. 625 nm, 500 nm
3. 380 nm, 525 nm
4. 380 nm, 500 nm

Correct: 2

25. A 2 W carbon resistor is color coded with green, black, red and brown respectively. The maximum current which can be passed through this resistor is :
1. 20mA
2. 0.4 mA
3. 100 mA
4. 63 mA

Correct: 1

26. Using a nuclear counter the count rate of emitted particles from a radioactive source is measured. At t=0 it was 1600 counts per second and t=8 seconds it was 100 counts per second. The count rate observed, as counts per second, at t=6 seconds is close to :
1. 200
2. 360
3. 150
4. 400

Correct: 1

27. Water flows into a large tank with flat bottom at the rate of $10^{-4} \mathrm{m^3 s^{-1}}$ Water is also leaking out of a hole of area $1 \mathrm{cm}^2$ at its bottom. If the height of the water in the tank remains steady, then this height is :

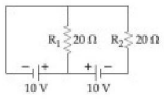
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1. 4 cm
2. 5.1 cm
3. 2.9 cm
4. 1.7 cm

Correct: 2

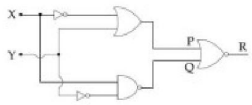
28. In the given circuit the cells have zero internal resistance. The currents (in Amperes) passing through resistance R1 and R2 respectively, are:



1. 0,1
2. 1, 2
3. 2,2
4. 0.5, 0

Correct: 4

29. To get output '1' at R, for the given logic gate circuit the input values must be :



1. X=1, Y=0
2. X=1, Y=1
3. X=0, Y=1
4. X=0, Y=0

Correct: 1

30. A string of length 1 m and mass 5 g is fixed at both ends. The tension in the string is 8.0 N. The string is set into vibration using an external vibrator of frequency 100 Hz. The separation between successive nodes on the string is close to
1. 10.0 cm
2. 16.6 cm
3. 20.0 cm
4. 33.3 cm

Correct: 3

Chemistry

1. A process has $\Delta \mathrm{H}=200 \mathrm{Jmol}^{-1}$ and $\Delta S=40 \mathrm{JK}^{-1} \mathrm{mol}^{-1}$ Out of the values given below, choose the minimum temperature above which the process will be spontaneous :
1. 5K
2. 20 K
3. 12 K

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4. 4K
Correct: 1

2. The metal used for making X-ray tube window is :
1. Be
2. Mg
3. Na
4. Ca

Correct: 1

3.A mixture of 100 m mol of $Ca(OH)_2$ and 2 g of sodium sulphate was dissolved in water and the volume was made up to 100 mL. The mass of calcium sulphate formed and the concentration of OH^- in resulting solution, respectively, are: (Molar mass of $Ca(OH)_2$, Na_2SO_4 and $CaSO_4$ are 74,143 and 136 $g mol^{-1}$ respectively K_{sp} of $Ca(OH)_2$ is 5.5×10^{-6})

1. $1.9 g, 0.28 mol L^{-1}$
2. $13.6 g, 0.28 mol L^{-1}$
3. $1.9 g, 0.14 mol L^{-1}$
4. $13.6 g, 0.14 mol L^{-1}$

Correct: 1

4. The chemical nature of hydrogen peroxide is :

1. Oxidising and reducing agent in both acidic and basic medium.
2. Oxidising agent in acidic medium, but not in basic medium.
3. Oxidising and reducing agent in acidic medium, but not in basic medium.
4. Reducing agent in basic medium, but not in acidic medium.

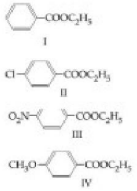
Correct: 1

5. The total number of isomers for a square planar complex $[M(F)(Cl)(SCN)(NO_2)]$ is :

1. 4
2. 12
3. 8
4. 16

Correct: 2

6. The decreasing order of ease of alkaline hydrolysis for the following esters is



1. III >II>I>IV
2. III > II > IV> I
3. IV > II > III >I
4. II > III >I>IV

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Correct: 1

7. The electronegativity of aluminium is similar to :
1. Boron
2. Lithium
3. Beryllium
4. Carbon

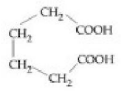
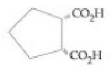
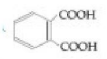
Correct: 3

8. Which of the following is not an example of heterogeneous catalytic reaction ?
1. Haber's process
2. Hydrogenation of vegetable oils
3. Combustion of coal
4. Ostwald's process

Correct: 3

9. Two pi and half sigma bonds are present in :
1. O_2
2. O_2^+
3. N_2
4. N_2^+

Correct: 4

10. Which dicarboxylic acid in presence of a dehydrating agent is least reactive to give an anhydride ?
1. 
2. 
3. 
4. 

Correct: 1

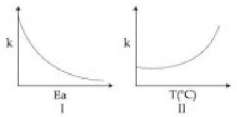
11. The total number of isotopes of hydrogen and number of radioactive isotopes among them, respectively, are :
1. 2 and 1
2. 3 and 2
3. 2 and 0
4. 3 and 1

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Correct: 4

12. Consider the given plots for a reaction obeying Arrhenius equation (0°C < T < 300°C): (k and E_a are rate constant and activation energy, respectively)



1. I is right but II is wrong
2. Both I and II are wrong
3. I is wrong but II is right
4. Both I and II are correct

Correct: 4

13. Which hydrogen in compound (E) is easily replaceable during bromination reaction in presence of light?

$$\underset{(\mathrm{E})}{\mathrm{CH_3-\overset{\gamma}{CH_2}-CH=CH_2}}$$

1. α hydrogen
2. γ hydrogen
3. β hydrogen
4. δ hydrogen

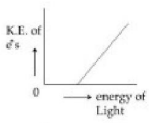
Correct: 2

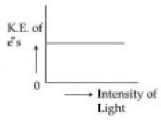
14. The effect of lanthanoid contraction in the The lanthanoid series of elements by and large means :

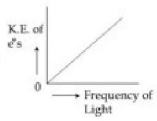
1. decrease in atomic radii and increase in ionic radii
2. increase in both atomic and ionic radii
3. increase in atomic radii and decrease in ionic radii
4. decrease in both atomic and ionic radii

Correct: 4

15. Which of the graphs shown below does not represent the relationship between incident light and the electron ejected from metal surface?

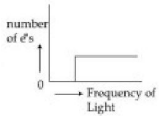
1. 

2. 

3. 

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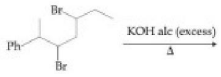
4. 

Correct: 3

16. The type of hybridisation and number of lone pair(s) of electrons of Xe in respectively, are:
1. sp^3d and 2
2. sp^3d^2 and 2
3. sp^3d^2 and 1
4. sp^3d and 1

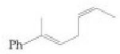
Correct: 3

17. The major product of the following reaction is :



1. 

2. 

3. 

4. 

Correct: 1

18. Consider the following reduction processes :

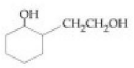
$$Zn^{2+} + 2e^- \rightarrow Zn(s); E^o = -0.76V$$

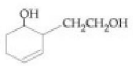
$$Ca^{2+} + 2e^- \rightarrow Ca(s); E^\circ = -2.87V$$

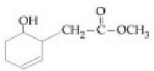
$$Mg^{2+} + 2e^- \rightarrow Mg(s); E^o = -2.36V$$

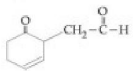
$$Ni^{2+} + 2e^- \rightarrow Ni(s); E^o = -0.25V$$

The reducing power of the metals increases in the order
1. Ca< Zn

1. 

2. 

3. 

4. 

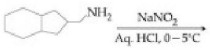
Correct: 3

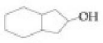
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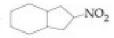
23. If dichloromethane (DCM) and water $(H_2O)$are used for differential extraction, which one of the following statements is correct?
1. DCM and (H_2O) will be miscible clearly
2. DCM and (H_2O) would stay as lower and upper layer respectively in the S.F.
3. DCM and (H_2O) would stay as upper and lower layer respectively in the separating funnel (S.F.)
4.DCM and (H_2O) will make turbid/ colloidal mixture

Correct: 2

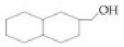
24. The major product formed in the reaction given below will be:



1. 

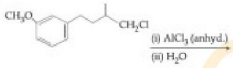
2. 

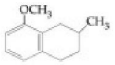
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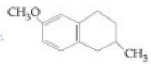
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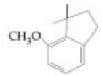
Correct: Dropped

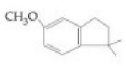
25. The major product of the following reaction is :



1. 

2. 

3. 

4. 

Correct: 4

26. The values of K_p/K_c for the following reactions at 300 K are, respectively : (At 300 K, RT = $24.62 dm^3 atm mol^{-1}$)

$N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$

$N_2O_4(g) \rightleftharpoons 2NO_2(g)$

$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

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1. $24.62\mathrm{dm^3atmmol^{-1}}$, $606.0\mathrm{dm^6atm^2mol^{-2}}$, $1.65\times10^{-3}\mathrm{dm^{-6}atm^{-2}mol^2}$
2. $1, 24.62\mathrm{dm^3atmmol^{-1}}$ $606.0\mathrm{dm^6atm^2mol^{-2}}$
3. $1, 24.62\mathrm{dm^3atmmol^{-1}m}$ $1.65\times10^{-3}\mathrm{dm^{-6}atm^{-2}mol^2}$
4. $1, 4.1\times10^{-2}\mathrm{dm^{-3}atm^{-1}mol}$ $606\mathrm{dm^6atm^2mol^{-2}}$

Correct: 3

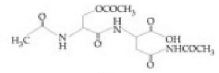
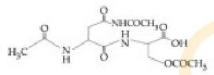
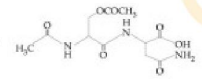
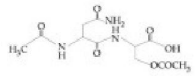
27. Which premitive unit cell has unequal edge lengths $(a \neq b \neq c)$ and all axial angles different from 90°?

1. Monoclinic
2. Triclinic
3. Tetragonal
4. Hexagonal

Correct: 2

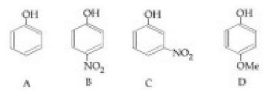
28. The correct structure of product 'P" in the following reaction is:



1. 
2. 
3. 
4. 

Correct: 4

29. The increasing order of the pKa values of the following compounds is :



1. D< A < C < B
2. B < C < A < D
3. C < B < A < D
4. B < C < D < A

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Correct: 2

30. Hall- Heroult 's process is given by:
1. $Cu^{2+}(aq) + H_2(g) \rightarrow Cu(s) + 2H^+(aq)$
2. $2Al_2O_3 + 3C \rightarrow 4Al + 3CO_2$
3. $Cr_2O_3 + 2Al \rightarrow Al_2O_3 + 2Cr$
4. $ZnO + C_1673KZn + CO$

Correct: 2

Mathematics

1. If a circle C passing through the point (4,0) touches the circle $x^2 + y^2 + 4x - 6y = 12$ externally at the point (1, -1), then the radius of C is :

1. $\sqrt{57}$
2. 5
3. $2\sqrt{5}$
4. 4

Correct: 2

2. If the area enclosed between the curves $y = kx^2$and $x = ky^2$ (k>0), is 1 square unit. Then k is :
1. √3/2
2. 2/√ 3
3. 1/√ 3
4. √ 3

Correct: 3

3. A point P moves on the line $2x - 3y + 4 = 0$. If Q(1,4) and R(3, -2) are fixed points, then the locus of the centroid of ΔPQR is a line:
1. Parallel to x-axis
2. parallel to y-axis
3. with slope 3/2
4. with slope 2/3

Correct: 4

4. The equation of a tangent to the hyperbola $4x^2 - 5y^2 = 20$ parallel to the line x-y=2 is :
1. $x - y - 3 = 0$
2. $x - y + 9 = 0$
3. $x - y + 1 = 0$
4. $x - y + 7 = 0$

Correct: 3

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5. If $\sum_{i=1}^{20}\left(\frac{^{20}C_{i-1}}{20}C_i +^2 C_{i-1}\right)^3 = \frac{k}{21}$ then k equals

1. 50
2. 200
3. 100
4. 400

Correct: 3

6. Consider a triangular plot ABC with sides AB=7 m, BC=5 m and CA=6 m. A vertical lamp-post at the mid point D of AC subtends an angle 30° at B. The height (in m) of the lamp-post is :

1. $2\sqrt{21}$
2. $\frac{2}{3}\sqrt{21}$
3. $7\sqrt{3}$
4. $\frac{3}{2}\sqrt{21}$

Correct: 2

7. Let $d \in \mathbf{R}$,and $A = \begin{bmatrix} -2 & 4+d & (\sin\theta)-2 \\ 1 & (\sin\theta)+2 & d \\ 5 & (2\sin\theta)-d & (-\sin\theta)+2+2d \end{bmatrix}$ If the minimum value of det(A) is 8 , then a value of det (A) is 8 then a value of d is

1. $2(\sqrt{2}+2)$
2. -7
3. -5
4. $2(\sqrt{2}+1)$

Correct: 3

8. Let $f : \mathbf{R} \to \mathbf{R}$ be a function such that $f(x) = x^3 + x^2 f'(1) + x f''(2) + f'''(3), x \in \mathbf{R}$ .Then f (2) equals :

1. - 4
2. 8
3. - 2
4. 30

Correct: 3

9. The shortest distance between the point (3, 0)and the curve y=V7, (x>0), is :

1. 3/2
2. √5/2
3. √3/2
4. 5/4

Correct: 2

10. Let $f(x) = \begin{cases} \max\{|x|, x^2\}, & |x| \le 2 \\ 8-2|x|, & 2 < |x| \le 4 \end{cases}$ Let S be the set of points in the interval (-4, 4) at

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which f is not differentiable.
Then S:
1. equals {-2,2}
2. Equals {-2, -1,1,2}
3. is an empty set
4. equals {-2, -1,0, 1, 2}

Correct: 4

11. The plane passing through the point (4,-1, 2) and parallel to the lines $\frac{x+2}{3} = \frac{y-2}{-1} = \frac{z+1}{2}$ and $\frac{x-2}{1} = \frac{y-3}{2} = \frac{z-4}{3}$ also passes through the point
1. (1,1,1)
2. (-1, -1, -1)
3. (1,1, -1)
4. (-1,-1,1)

Correct: 1

12. If the line 3x+4y - 24 = 0 intersects the x-axis at the point A and the y-axis at the point B, then the incentre of the triangle
OAB, where is the origin, is
1. (4,4)
2. (2, 2)
3. (3, 4)
4. (4,3)

Correct: 2

13. Let A be a point on the line $\vec{r} = (1-3\mu)\hat{i} + (\mu-1)\hat{j} + (2+5\mu)\hat{k}$ and B(3,2,6) be a point in the space. Then the value of μ for which the vector AB vector is parallel to the plane x - 4y + 3z=1 is :
1. 1/4
2. 1/8
3. 1/2
4. -1/4

Correct: 1

14. If the system of equations
x+y+z=5
x+2y+3z=9
$x + 3y + \alpha z = \beta$ has infinitely many solutions, then $\beta - \alpha$
equals
1. 5
2. 8
3. 21
4. 18

Correct: 2

15. The sum of all values of $\theta \in \left(0, \frac{\pi}{2}\right)$ satisfying $\sin^2 2\theta + \cos^4 2\theta = \frac{3}{4}$ is
1. π
2. 3π/8
3. 5π

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4. π/2

Correct: 4

16. Consider the statement: "$P(n) : n^2 - n + 41$ is prime." Then which one of the following is true ?
1. P(5) is false but P(3) is true.
2. P(3) is false but P(5) is true.
3. Both P(3) and P(5) are false.
4. Both P(3) and P(5) are true.

Correct: 4

17. The sum of all two digit positive numbers which when divided by 7 yield 2 or 5 as remainder is
1. 1256
2. 1356
3. 1365
4. 1465

Correct: 2

18. An unbiased coin is tossed. If the outcome is a head then a pair of unbiased dice is rolled and the sum of the numbers obtained on them is noted. If the toss of the coin results in tail then a card from a well-shuffled pack of nine cards numbered
1, 2, 3, ..., 9 is randomly picked and the number on the card is noted. The probability that the noted number is either 7 or 8 is :
1. 15/72
2. 13/36
3. 19/72
4. 19/36

Correct: 3

19. Let $n \geqslant 2$ be a natural number and $0 < \theta < \pi/2$ Then $\int \frac{(\sin^n\theta - \sin\theta)^{\frac{1}{n}}\cos\theta}{\sin^{n+1}\theta} d\theta$ is equal to (where C is a constant of integration)
1. $\frac{n}{n^2+1}\left(1-\frac{1}{\sin^{n-1}\theta}\right)^{\frac{n+1}{n}} + C$
2. $\frac{n}{n^2-1}\left(1-\frac{1}{\sin^{n-1}\theta}\right)^{\frac{n+1}{n}} + C$
3. $\frac{n}{n^2-1}\left(1+\frac{1}{\sin^{n-1}\theta}\right)^{\frac{n+1}{n}} + C$
4. $\frac{n}{n^2-1}\left(1-\frac{1}{\sin^{n+1}\theta}\right)^{\frac{n+1}{n}} + C$

Correct: 2

20. If the parabolas $y^2 = 4b(x-c)$ and $y^2 = 8ax$ have a common normal, then which one of the following is a valid choice for the ordered triad (a, b, c)?
1. (1,1,3)
2. (1,1,0)
3. (½,2,3)

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4. (½,2,0)

Correct: 1

21. If the third term in the binomial expansion of $\left(1+x^{\log_2 x}\right)^5$ equals 2560, then a possible value of x is :

1. 1/8
2. 1/4
3. 4√2
4. 2√2

Correct: 2

22. If 5, 5r, $5r^2$ are the lengths of the sides of a triangle, then r cannot be equal to:
1. 5/4
2. 3/2
3. 3/4
4. 7/4

Correct: 4

23. Let $\vec{a}=2\hat{i}+\lambda_1\hat{j}+3\hat{k}, \vec{b}=4\hat{i}+(3-\lambda_2)\hat{j}+6\hat{k}$ and $\vec{c}=3\hat{i}+6\hat{j}+(\lambda_3-1)\hat{k}$ be three vectors such that B=2a and a is perpendicular
to c vector . Then a possible value of ($\lambda_1, \lambda_2, \lambda_3$) is:
1. (½,4,-2)
2. (-½,4,0)
3. (1,3,1)
4. (1,5,1)

Correct: 2

24. Consider the quadratic equation $(c-5)x^2-2cx+(c-4)=0, c\neq 5$. Let S be the set of all integral values of c for which one root of the equation lies in the interval (0, 2) and its other root lies in the interval (2,3). Then the number of elements in S is

1. 11
2. 12
3. 10
4. 18

Correct: 1

25. Let z_1 and z_2 , be any two non-zero complex numbers such that $3|z_1|=4|z_2|$
If $z=\frac{2z_2}{3z_1}+\frac{3z_1}{2z_2}$ then:
1. $|z|=\sqrt{\frac{5}{2}}$
2. $|z|=\frac{1}{2}\sqrt{\frac{17}{2}}$
3. Im(z)=0
4. Re(z)=0

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Correct: 2

26. The mean of five observations is 5 and their variance is 9.20. If three of the given five observations are 1, 3 and 8, then a ratio of other two observations is :

1. 6:7
2. 4:9
3. 5:8
4. 10:3

Correct: 2

27. If $\frac{dy}{dx}+\frac{3}{\cos^2 x}y=\frac{1}{\cos^2 x}, x\epsilon\left(\frac{-\pi}{3},\frac{\pi}{3}\right)$ and $y\left(\frac{\pi}{4}\right)=\frac{4}{3},$ then $y\left(-\frac{\pi}{4}\right)$ equals :
1. $\frac{1}{3}+e^6$
2. -4/3
3. $\frac{1}{3}+e^3$
4. 1/3

Correct: 1

28. Let $I=\int_a^b\left(x^4-2x^2\right)dx$. If I is minimum then the ordered pair (a, b) is :
1. (- √2,0)
2. (0, √2)
3. (√2, - √2)
4.(- √2, √2)

Correct: 4

29. In a class of 140 students numbered 1 to 140, all even numbered students opted Mathematics course, those whose number is divisible by 3 opted Physics course and those whose number is divisible by 5 opted Chemistry course. Then the number of students who did not opt for any of the three courses is:

1. 102
2. 38
3. 1
4. 42

Correct: 2

30. For each teR let [t] be the greatest integer less than or equal to t. Then,
$\lim_{x\to1^+}\frac{(1-|x|+\sin|1-x|)\sin\left(\frac{\pi}{2}[1-x]\right)}{|1-x|[1-x]}$
1. equals - 1
2. equals 0
3. does not exist
4. equals 1

Correct: 2

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