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KIITEE Biotechnology (B.Tech & M.Tech)- Maths Biology Exam Paper

Kalinga Institute of Industrial Technology Entrance Examination

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Subject : PCM

Topic : Physics

Q1 : Unit used to represent nuclear diameter is

- A** nm
- B** Fermi
- C** μm
- D** \AA

Q2 : By measuring a physical parameter in your experiment several times and then taking the average, you improve your result by reducing

- A** Random error
- B** Systematic error
- C** Least count error
- D** Constant error

Q3 : If $|\vec{A}| = 5$, $|\vec{B}| = 2$, and $\vec{A} \times \vec{B} = -3\hat{k} + 4\hat{i}$. The angle between \vec{A} and \vec{B} is

- A** 45°
- B** 60°
- C** 30°
- D** 90°

Q4 : A ball is dropped from a height of 125 m on a floor. At each collision with the floor, the ball loses one-tenth of its speed. The time taken by the ball to reach maximum height after first rebound is (given $g=10 \text{ m/s}^2$)

A	5 s
----------	-----

B 4.5 s

C 0.5 s

D 9.5 s

Q5 : A projectile is following $y = \frac{1}{\sqrt{3}}x - \frac{1}{375}x^2$ (take $g = 10 \text{ m/s}^2$) The initial velocity of the projectile is

A 20 m/s

B 40 m/s

C 50 m/s

D 100 m/s

Q6 : An airplane takes off at sea level and climbs to a height of 500 m. The net outward force on a passenger's eardrum assuming the density of air is approximately constant at 1.3 kg/m^3 and that the inner ear pressure hasn't been equalized (take area of an eardrum as 1 square cm; $g = 10 \text{ m/s}^2$).

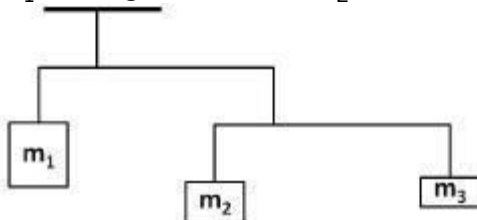
A 0.65 N

B 6.5 N

C 65 N

D 0.065 N

Q7 : Three masses are hanging from a ceiling shown in figure. Each crossbar is horizontal, has negligible mass, and extends three times as far to the right of the wire supporting to it to the left. The mass of $m_1 = 12 \text{ kg}$. The mass of m_2 would be



A 1 kg

B 2 kg

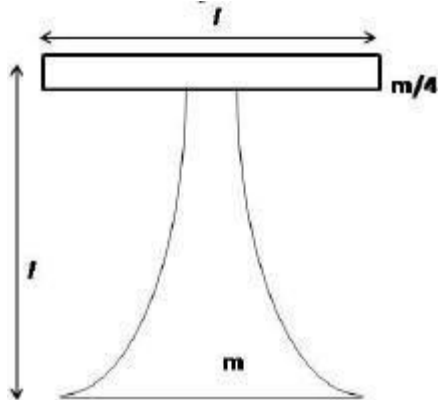
C 3 kg

D 4 kg

Q8 : The inclined plane with inclination of $\theta = 30^\circ$ have first quarter from the top smooth surface and the remaining is rough surface. A block starting from rest at the top and come to the rest at the bottom.
The coefficient of friction for the rough would be

- A $\frac{4}{3\sqrt{3}}$
- B $\frac{3}{4}$
- C $\frac{4}{3}$
- D $\frac{\sqrt{3}}{4}$

Q9 : 'T' shaped structure shown in figure with different mass and same length. The linear mass density of top block is constant whereas of the base increases quadratically. Where would be the center of mass from the ground level



- A $3l/4$
- B $l/4$
- C $3l/5$
- D $2l/5$

Q10 A force F (in N) = $4\hat{i} + 3\hat{j}$ is applied on a stationary object of mass 2 kg. The distance of the object after 2 s will be

- A 3 m

B 4 m

C 5 m

D 9 m

Q11 The output of an AND gate with three inputs, A, B, and C, is HIGH when :

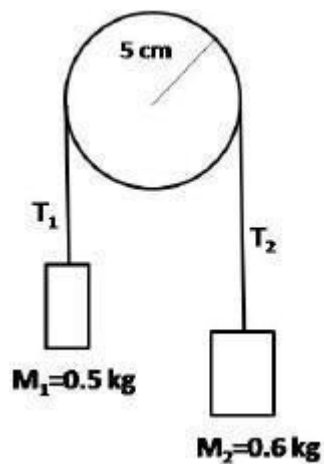
A $A=1, B=0, C=0$

B $A=1, B=1, C=0$

C $A=1, B=1, C=1$

D $A=1, B=0, C=1$

Q12 Two different masses are attached with a string on a pulley (shown in the figure). The mass m_2 falls 75 cm in 5 s. What is the tension T_1 (take $g=9.8 \text{ m/s}^2$)



A 4.93 N

B 4.79 N

C 5.88 N

D 5.84 N

Q13 The acceleration of a particle is given by $a_x(t) = -2 + 3t$ (in SI unit). What would be the initial velocity (m/s) such that the particle will be having same x-coordinate at $t = 4 \text{ s}$ as it had at $t = 0 \text{ s}$.

A 0

B -2

C	-4
D	-8

Q14 A pendulum having mass 2 kg stone swinging on 4.0 m long massless string. The speed at the lowest point is 7m/s. The speed at a height when the string is at 60° to the vertical ($g=10 \text{ m/s}^2$)

- A** 3
- B** 5
- C** 7
- D** 8

Q15 Two living insects, each of mass 'm' rides on a horizontal disk of mass '5 m' and radius 'R'. The disk rotates around its vertical symmetric axis at an angular speed 7 rad/s. The insects are initially at 'R/2' from the the center of the axis of rotation but one crawls to the center and other out to the rim of the disk. The final angular momentum (rad/s) will be

- A** 7
- B** 6
- C** 5
- D** 4

Q16 The value of temperature co-efficient of a material which is used in precision wire-wound resistors :

- A** $-5\Omega/^\circ\text{C}$
- B** $0\Omega/^\circ\text{C}$
- C** $5 /^\circ\text{C}$
- D** $100\Omega/^\circ\text{C}$

Q17 The minimum voltage required for producing K-line in the Lead (Pb) is 90 kV and corresponding K-absorption edge is 0.15\AA . The ratio h/e (in SI unit) will be

A	13.5×10^{-15}
----------	------------------------

- B** 1.5×10^{-15}
- C** 4.5×10^{-15}
- D** 3.0×10^{-15}

Q18 The Carnot engine operate between temperature 127°C and 27°C . The efficiency of the engine is :

- A** 75%
- B** 25%
- C** 79%
- D** 21%

Q19 Water storage tank (radius of 0.25 m) is filled 2.1 m deep and sealed from top. The space above water surface contains air having pressure 1.5 times the atmospheric pressure. Water flows out from the bottom through a narrow pipe with radius 0.7 cm. The volume flow rate (l/s) will be (given $g=10 \text{ m/s}^2$)

- A** 1.85
- B** 12
- C** 1.54
- D** 1.2

Q20 The fringe width 0.3 mm is estimated using Sodium light ($\lambda = 5890 \text{ \AA}$) in biprism experiment. On introducing a thin glass of refractive index 1.5 in half of the beam the central fringe shifted by 2.1 mm. The thickness (in μm) of the glass sheet is

- A** 16.5
- B** 8.25
- C** 4.1
- D** 2.06

Q21 A single slit of width $2 \mu\text{m}$ is illuminated by light of wavelength 600 nm. The approximate angular spread (in radian) of the central maxima of diffraction pattern will be

- | | |
|----------|-----|
| A | 0.3 |
|----------|-----|

B 0.6

C 1.2

D 2.4

Q22 The human eye is most sensitive to light of wavelength 600 nm. The separation between two points on the moon that can be resolved by a telescope of 1m objective lens aperture will be (the distance of the moon is 5×10^5 km)

A 100 m

B 122 m

C 244 m

D 366 m

Q23 The reflected light from a surface whose refractive index is 1.732 completely polarized. The angle of refraction would be

A 30°

B 60°

C 90°

D 45°

Q24 A particle of mass 200 g is placed in a field of potential $U(\text{ergs}) = \alpha x^2 + 5$, oscillates with angular frequency of 2 rad/s. The constant α (dyne/cm²) is

A 100

B 200

C 300

D 400

Q25 The electric field of an EM wave is given by $\vec{E}(z,t) = 15\sqrt{2} \sin [2\pi(1.67 \times 10^6 z - 5 \times 10^{14} t)] (\hat{i} + \hat{j})$ (N/C).
The maximum amplitude of the magnetic field (in T) is

A 1×10^{-7}

- B** 5×10^{-7}
- C** 7.07×10^{-7}
- D** $5\sqrt{2} \times 10^{-7}$

Q26 The speed of voltage wave in an electrical circuit containing inductance per unit length (L_0) and conductance per unit length (C_0) is

- A** $1/\sqrt{L_0 \cdot C_0}$
- B** $\sqrt{L_0/C_0}$
- C** $\sqrt{C_0/L_0}$
- D** $\sqrt{L_0 \cdot C_0}$

Q27 A point charge of $53.5 \mu\text{C}$ is enclosed at the center of the cube of side 6 cm. The electric flux (in SI unit) through one face of the cube will be ($\epsilon_0 = 8.85 \times 10^{-12}$ SI unit)

- A** 1×10^6
- B** 2×10^6
- C** 3×10^6
- D** 4×10^6

Q28 Half-life of an element is 12 Hrs. How long does it take for 93.75% of this sample to decay :

- A** 24 Hrs
- B** 36 Hrs
- C** 48 Hrs
- D** 72 Hrs

Q29 Two closed organ pipe sounded simultaneously gives 5 beats/s between the fundamental. If shorter organ pipe is 1 m long , the length (in m) of the longer pipe will be (Take speed of sound = 340 m/s)



- A** 1.16
- B** 1.10
- C** 1.06
- D** 1.01

Q30 The lattice constant 'a' of a substance having 'fcc' lattice
: ($M_w=60.23$ and density 400 kg/m^3 ; $N_A = 6.023 \times 10^{23}$)

- A** 5 \AA
- B** 10 \AA
- C** 20 \AA
- D** 40 \AA

Q31 The packing fraction of diamond crystal which has double fcc structure is
:

- A** 74%
- B** 68%
- C** 52%
- D** 34%

Q32 Two identical pith balls are charged by rubbing against each other. The charge on each ball has a
: magnitude $2.0 \times 10^{-8} \text{ C}$. They are suspended from a horizontal rod through two strings of length 10 cm each, the separation between the suspension points being 15 cm . In equilibrium, the separation between the balls is 3 cm . The tension in the string will be ($1/4\pi\epsilon_0 = 9 \times 10^9 \text{ SI unit}$)

- A** $0.67 \times 10^{-2} \text{ N}$
- B** $0.33 \times 10^{-2} \text{ N}$
- C** $0.9 \times 10^{-2} \text{ N}$
- D** $0.1 \times 10^{-2} \text{ N}$

Q33 A wire is bent in the form of a regular hexagon of each side 2 m and a total charge q is distributed uniformly on it. The electric field at the centre is

- A 0
- B $6 q/\epsilon_0$
- C $3 q/\epsilon_0$
- D $0.25 q/\epsilon_0$

Q34 A cylindrical capacitor is constructed using two coaxial cylinders of the same length $18\ln 2$ cm and of radii 2 mm and 4 mm. The capacitance.

- A 10 pF
- B 100 pF
- C 1 pF
- D 0.1 pF

Q35 Protons of mass ' m ' having kinetic energy ' K ' emerge from an accelerator as a narrow beam. The beam is bent by a perpendicular magnetic field so that it just misses a plane target kept at a distance ' l ' in front of the accelerator. The magnetic field will be

- A $\sqrt{2mK}/ql$
- B $2\sqrt{mK}/ql$
- C $\sqrt{2K}/mql$
- D $\sqrt{mK}/2ql$

Q36 A planet is 2 times more massive than the Earth and its radius is 2 times smaller. The escape velocity from the surface of the planet would be (given, escape velocity from the Earth surface is 11.2 km/s)

- A 5.6
- B 11.2
- C 22.4
- D $11.2\sqrt{2}$

Q37 A transformer has 50 turns in the primary and 100 in the secondary. If the primary is connected to a 220 V AC supply. The voltage across the secondary will be

- A 0 V
- B 440 V
- C 110 V
- D 1100 V

Q38 A coil has a resistance of 10Ω and an inductance of 0.4 Henry. It is connected to an AC source of

: 6.5V, $30/\pi$ Hz. Find the average power (in W) consumed in the circuit

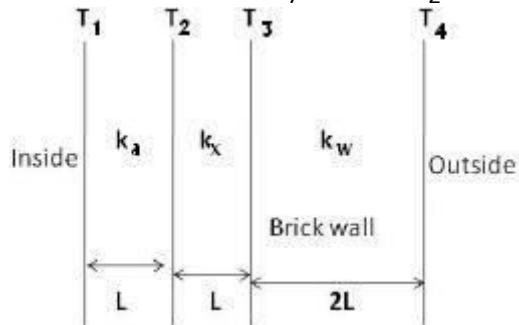
- A 1.625
- B 2.82
- C 1.82
- D 0.625

Q39 A student in Biology lab leaves the door open of the freezer which has 5 kg ice at -80°C . After few hrs all ice melted to water and temperature reads 20°C . How much heat must be absorbed by the ice (Specific heat of ice = 2200 J/kg-K ; heat of fusion = 350 kJ/kg , and specific heat of liquid water = 4200 J/kg-K)

- A 3050 kJ
- B 1300 kJ
- C 2170 kJ
- D 2630 kJ

Q40 : The thermostat was set at 20°C in a house in Canada where outside temperature is -40°C . The wall of the house has three layers with different thickness and conductivity shown in figure. The conductivity of brick layer (k_w) is five times the plywood layer (k_a). The thermal conduction through

the wall has reached the steady state. If $T_2 = 15^{\circ}\text{C}$ then temperature T_3 will be



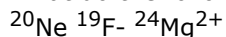
- A -38°C
- B -35°C
- C -30°C
- D -33°C



Subject : PCM

Topic : Chemistry

Q1 : What do the following have in common?



- A** They are isotopes of each other
- B** They are isoelectronic with each other
- C** They are isomers of each other
- D** They are different elements so they have nothing in common

Q2 : Which of the following statements in relation to the hydrogen atom is correct?

- A** 3s orbital is lower in energy than 3p orbital
- B** 3p orbital is lower in energy than 3d orbital
- C** 3s and 3p orbitals are of lower energy than 3d orbital
- D** 3s, 3p and 3d orbitals all have the same energy

Q3 : An unused flash bulb contains magnesium and oxygen. After use, the contents are changed to magnesium oxide but the total mass does not change. This observation can best be explained by the

- A** Law of Constant Composition.
- B** Law of Conservation of Mass.
- C** Law of Multiple Proportions.
- D** Avogadro's Law.

Q4 : Calculate the energy of one mole of light that has a wavelength of 400 nm?

- | | |
|----------|----------------------------------|
| A | $2.99 \times 10^{-4} \text{ J}$ |
| B | $4.97 \times 10^{-28} \text{ J}$ |
| C | $2.99 \times 10^5 \text{ J}$ |

D $4.97 \times 10^{-19} \text{ J}$

Q5 : Rutherford carried out experiments in which a beam of alpha particles was directed at a thin piece of metal foil. From these experiments he concluded that:

- A** electrons are massive particles.
- B** the positively charged parts of atoms are moving about with a velocity approaching the speed of light.
- C** the positively charged parts of atoms are extremely small and dense.
- D** the diameter of an electron is approximately equal to that of the nucleus.

Q6 : Which noble gas is most abundant in atmosphere?

- A** He
- B** Ne
- C** Ar
- D** Kr

Q7 : Identify the "**INCORRECT STATEMENT**".

- A** Helium in a balloon: an element
- B** Paint: a mixture
- C** Kerosene: a compound
- D** Mercury in a barometer; an element.

Q8 : Which of the following sets of quantum numbers is correct for an electron in 4f orbital?

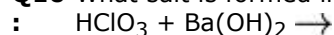
- A** $n = 4, l = 3, m_l = +4, s = +1/2$
- B** $n = 3, l = 2, m_l = -2, s = +1/2$
- C** $n = 4, l = 3, m_l = +1, s = +1/2$
- D** $n = 4, l = 4, m_l = -4, s = -1/2$

Q9 : Calculate the mass of hydrogen formed when 25 grams of aluminum reacts with excess hydrochloric acid.
(At. wt. of Al = 27)



- A** 0.41 g
- B** 1.2 g
- C** 1.8 g
- D** 2.8 g

Q10 What salt is formed in the following acid/base reaction?



- A** BaCl_2
- B** BaOCl
- C** BaClO_3
- D** $\text{Ba}(\text{ClO}_3)_2$

Q11 Which of the following is classified as a metal?

:

- A** Ge
- B** As
- C** V
- D** F

Q12 $[\text{CoCl}_2(\text{NH}_3)_2(\text{en})]$ can exhibit

:

- A** geometrical isomerism
- B** coordination isomerism
- C** linkage isomerism
- D** optical isomerism

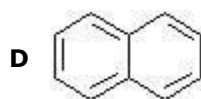
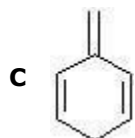
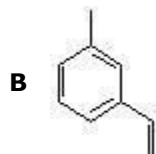
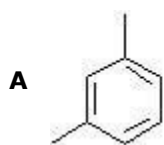
Q13 What is the frequency of light having a wavelength of $4.50 \times 10^{-6} \text{cm}$?

:

- A** $1.06 \times 10^{22} \text{ s}^{-1}$
- B** $2.10 \times 10^4 \text{ s}^{-1}$
- C** $4.29 \times 10^{14} \text{ s}^{-1}$
- D** $6.67 \times 10^{15} \text{ s}^{-1}$

Q14 Which of the following compound is non aromatic?

:



Q15 A compound A has molecular formula $\text{C}_7\text{H}_7\text{NO}$. On treatment with Br_2 and KOH , A gives an amine B which gives carbylamine test. B upon diazotization and coupling with phenol gives an azo dye. A is,

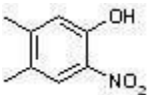
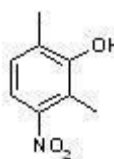
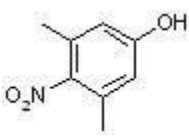
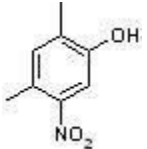
- A** Ph-CO-NH-COCH_3
- B** PhCONH_2

C PhNO_2

D PhCH_2NH_2

Q16 Which one of the following phenols is the strongest acid?

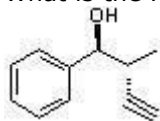
:

- A** 
- B** 
- C** 
- D** 

Q17 Aqueous solution of carbohydrate with 2 drops of alcoholic solution of α -naphthol and H_2SO_4 gives : a ring at the junction. The colour of the ring is,

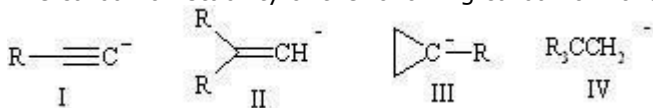
- A** Yellow
- B** Green
- C** Violet
- D** Red

Q18 What is the R, S Configuration of the following compound?



- A** 1R,2S
- B** 1S,2S
- C** 1R,2R
- D** 1S,2R

Q19 The carbanion stability of the following carbanion follows the order :



- A** I > II > III > IV
B I > III > II > IV
C III > I > II > I
D II > III > I > IV

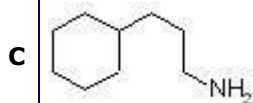
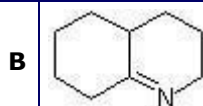
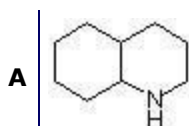
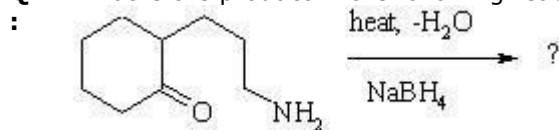
Q20 Addition of which of the reagent to 3-hexyne will lead to *trans*-3-hexene :

- A** H₂/Lindlar catalyst
B LiAlH₄
C Na/liq. NH₃
D NaBH₄

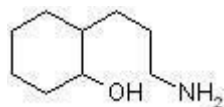
Q21 Replacement of Cl of chlorobenzene to give phenol requires drastic conditions but chlorine of 2, 4-dinitrochlorobenzene is readily replaced. This is because

- A** NO₂ makes the ring electron rich at ortho and para position.
B NO₂ withdraws e⁻ from meta position.
C NO₂ donates e⁻ at meta position.
D NO₂ withdraws e⁻ from ortho/para positions.

Q22 What is the product in the following reaction?

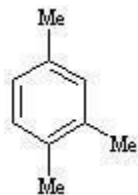


D

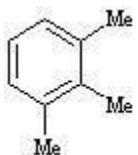


Q23 When passed through a heated tube propyne yield which of the following compound,
:

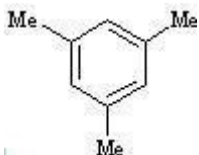
A



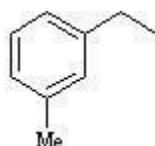
B



C

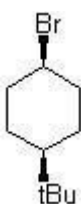


D

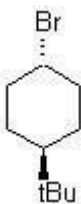


Q24 Which isomer will undergo E₂ elimination most readily?
:

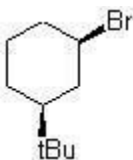
A



B



C



D none of the above

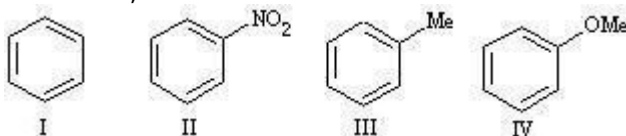
Q25 Ca-adipate on distillation gives ,
:

- A** cyclopentanone;
- B** cyclohexanone;
- C** cycloheptanone;
- D** 2-pentanone.

Q26 The structural feature which distinguishes proline from other natural α -amino acids is,
:

- A** It is optically inactive.
- B** It contains aromatic group.
- C** It is a dicarboxylic acid.
- D** It is a secondary amine.

Q27 Predict the correct order of affinity towards electrophilic substitution reaction of the following substrates,



- A** IV > III > I > II;
- B** III > IV > I > II;
- C** IV > I > III > II;
- D** I > II > III > IV

Q28 The correct basicity order for the following substituted aniline is
:



- A** $\text{OMe} < \text{Cl} < \text{Me} < \text{NO}_2$;
- B** $\text{NO}_2 < \text{Cl} < \text{Me} < \text{OMe}$;
- C** $\text{Cl} < \text{NO}_2 < \text{Me} < \text{OMe}$;
- D** $\text{Me} < \text{NO}_2 < \text{Cl} < \text{OMe}$

Q29 Which of the followings is an extensive property?
:

- A** Temperature
- B** Internal energy
- C** Molar volume
- D** Boiling point

Q30 For a spontaneous process which of the following must be true -
:

- A** Entropy of the system increase
- B** Entropy of the surroundings increase
- C** Entropy of the universe increase
- D** No change of entropy

Q31 If initial concentration of the reactant is reduced to $1/4^{\text{th}}$ in a 1st-order reaction, the new rate of
: the reaction will

- A** Remains same
- B** Doubles
- C** Becomes four times
- D** Becomes one-fourth

Q32 The boiling point of an azeotropic mixture of water and ethanol is less than that of water and
: ethanol. The mixture shows

- | | |
|----------|--------------------------------------|
| A | Positive deviation from Raoult's Law |
| B | Negative deviation from Raoult's Law |

- C No deviation from Raoult's Law
- D Deviations which cannot be predicted from the given information

Q33 What is the γ (C_p/C_v) value for an ideal monatomic gas?
:

- A 1.667
- B 1.28
- C 1.18
- D 1.15

Q34 Bohr's atomic model can explain
:

- A only the hydrogen spectra
- B the spectra of system with only one electron
- C the spectra of hydrogen molecule
- D solar spectra

Q35 The reason for increase in reaction rate with the increase in temperature is
:

- A lowering of activation energy
- B increase in the velocity of activated molecules
- C increase in the number of collisions
- D increase in the number of effective collisions

Q36 For an ideal gas, Joule-Thomson coefficient is
:

- A Positive
- B Negative
- C Zero
- D Dependent on molecular weight

Q37 Ionic mobility of Li^+ is less than Na^+ and K^+ because
:

- A Li has larger ionic radii
- B Ionisation potential of Li^+ is small
- C Extent of hydration is higher in case of Li^+
- D Li^+ contains two electrons

Q38 A negative value of packing fraction indicates that the isotope is
:

- A Unstable
- B Very stable

- C** Stable
- D** Artificial

Q39 The standard electrode potential of a Cu^{2+}/Cu electrode is 0.34 V. What is the electrode potential of a 0.02 (M) concentration of Cu^{2+} ?

- A** 0.29 V
- B** 0.39 V
- C** 0.22 V
- D** 0.18 V

Q40 Which of the following parameters are path functions? q is heat absorbed by the system, w is work done by the surroundings on the system

i) q ii) w iii) $H-TS$ iv) $q+w$

- A** i), ii) and iii)
- B** iii) and iv)
- C** ii) and iv)
- D** i) and ii)



Subject : PCM

Topic : Maths

Q1 : The length of the latus rectum of the parabola $(x+2)^2 = -14(y-5)$ is

- A** 7
- B** 14
- C** 21
- D** 28

Q2 : One of the foci of the hyperbola $\frac{x^2}{9} - \frac{y^2}{16} = 1$ is

- A** (3, 0)
- B** (4, 0)
- C** (5, 0)
- D** (9, 0)

Q3 : If the circles $x^2 + y^2 - 8x - 6y + c = 0$ and $x^2 + y^2 - 2y + d = 0$ cut orthogonally, then $c + d$ equals

- A** 6
- B** 4
- C** 2
- D** 0

Q4 : The radius of the circle which touches both axes and passes through the point (2, 1) can be

- | | |
|----------|---|
| A | 1 |
| B | 2 |
| C | 3 |
| D | 4 |



Q5 : The area of the triangle with vertices P(1, 2, 3), Q (4, 5, 6) and R(0, 0, 0) is

A $\sqrt{6}$

B $2\sqrt{6}$

C $3\sqrt{6}$

D $4\sqrt{6}$

Q6 : The unit vector in the direction of the vector \overrightarrow{AB} if A = (-2, -1, 3) and B = (1, 1, 0) is $\alpha i + \beta j + \gamma k$, then is $\alpha + \beta$ is

A $\frac{3}{\sqrt{22}}$

B $\frac{5}{\sqrt{22}}$

C $\frac{-3}{\sqrt{22}}$

D $\frac{-5}{\sqrt{22}}$

Q7 : If $\begin{pmatrix} 3x - y & x + 3y \\ 2x - z & 2y + z \end{pmatrix} = \begin{pmatrix} 7 & 9 \\ 5 & 5 \end{pmatrix}$, then x+y+z equals

A 3

B 6

C 9

D 12

Q8 :

If the product $abc = 1$, then the value of the determinant $\begin{vmatrix} -a^2 & ab & ac \\ ba & -b^2 & bc \\ ac & bc & -c^2 \end{vmatrix}$ is equal to

- A** 1
- B** 2
- C** 3
- D** 4

Q9 : If (x, y, z) is the solution of the equations

$$4x + y = 7,$$

$$3y + 4z = 5,$$

$$5x + 3z = 2,$$

then the value of $x+y+z$ equals

- A** 8
- B** 6
- C** 3
- D** 0

Q10

: If $\begin{pmatrix} e & f \\ g & h \end{pmatrix}$ is the inverse of the matrix $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$ where $ad - bc = 1$, then g equals

- A** c
- B** $-c$
- C** b
- D** $-b$

Q11 If $f: \mathbb{R} \rightarrow \mathbb{R}$ is a function defined by $f(x) = x^2$, then which of the following is true?

- A** f is 1-1 but not onto
- B** f is onto but not 1-1
- C** f is neither 1-1 nor onto
- D** f is both 1-1 and onto

Q12 Consider the set $A = \{1, 2, 3\}$ along with the relation $R = \{(1,1), (2,2), (1,2), (2,1), (3,3)\}$. Which of the following statements is true?

- A** The relation is symmetric but not transitive
- B** The relation is transitive but not symmetric
- C** The relation is neither symmetric nor transitive
- D** The relation is both symmetric and transitive

Q13 let $z_1 = 1+i\sqrt{3}$ and $z_2 = 1+i$, then $\arg(z_1/z_2)$ is :

- A** $\pi/3$
- B** $\pi/4$
- C** $\pi/6$
- D** $\pi/12$

Q14 Any non zero complex number z satisfying $|z-i| = |z+i|$ must lie on :

- A** real axis
- B** imaginary axis
- C** unit circle
- D** the line parallel to real axis through $z = i$

Q15 : The value of $\left[\cos\frac{\pi}{8} + i\sin\frac{\pi}{8}\right]^4$ is

- A** $-i\pi$
- B** $i\pi$
- C** i
- D** $-i$

Q16 If ω is the cube root of unity, then $(1 - \omega + \omega^2)^5 + (1 + \omega - \omega^2)^5$ equals :

- | | |
|----------|---|
| A | 1 |
|----------|---|

B 16

C 32

D 64

Q17

: The value of $\tan \left[\sin^{-1} \frac{5}{13} + \cot^{-1} \frac{4}{3} \right]$ is

A 26/11

B 56/33

C 63/41

D 65/43

Q18

: If $\tan^{-1} x + 2 \cot^{-1} x = \frac{\pi}{3}$, then the value of x is

A $-\sqrt{3}$

B $-\sqrt{2}$

C $\sqrt{2}$

D $\sqrt{3}$

Q19 Which of the following is not a solution of the following equation ?

: $3 \tan^2 \theta - \sin \theta = 0$

A $n\pi$

B $n \frac{\pi}{2}$

C $n + (-1)^n \frac{\pi}{6}$

D 0

Q20

: If $\sqrt{\frac{y}{x}} + \sqrt{\frac{x}{y}} = 1$, then $\frac{dy}{dx}$ equals

A

$$\sqrt{\frac{y}{x}}$$

- B** $\sqrt{\frac{x}{y}}$
- C** y/x
- D** x/y

Q21 : If $x = 3t/(1 + t^3)$ and $y = 3t^2/(1+t^3)$ then $\frac{dy}{dx}$ at $t=1$ equals

- A** -6
- B** -1
- C** 1
- D** 6

Q22 : The equation of the normal to the curve given by $x^2 + 2x - 3y + 3 = 0$ at the point (1,2) is

- A** $3x + 4y - 11 = 0$
- B** $3x - 4y + 11 = 0$
- C** $-3x + 4y + 11 = 0$
- D** $3x - 4y - 11 = 0$

Q23 : If $f(x) = x^5 - 5x + 5$ then which of the following is TRUE ?

- A** f attains maximum at $x = 1$
- B** f attains minimum at $x = 1$
- C** f attains maximum at $x = 0$
- D** f attains minimum at $x = -1$

Q24 : The value of the integral $\int_0^{\frac{\pi}{2}} \log \tan \theta \, d\theta$ is

- | | |
|----------|---|
| A | 0 |
| B | 1 |

C $\frac{\pi}{2}$

D $\log 2$

Q25 The area enclosed between the curve $y = 11x - 24 - x^2$ and the line $y = x$ is :

A $1/3$

B $3/4$

C 1

D $4/3$

Q26 The solution of the differential equation $\frac{dy}{dx} = y^2/x$ passing through the point $(1, -1)$ is :

A $1/y + \log x = 0$

B $1/y - \log x = 0$

C $y + \log x = 0$

D $y - \log x = 0$

Q27 The differential equation $e^x \frac{dy}{dx} + 3y = x^2y$ is :

A Separable and not linear

B Both separable and linear

C Linear and not separable

D Neither separable nor linear

Q28 Let the mean of n observations is μ . If the first term is increased by 1 and second by 2 and so on, then the new mean is

A $\mu + n$

B $\mu + n/2$

C $\mu + \frac{n(n+1)}{2}$

D $\frac{n+1}{2}$

Q29 The arithmetic mean and mode of a given data are 24 and 12 respectively. Then its median is :

- A** 25
- B** 18
- C** 20
- D** 22

Q30 The probability of getting two heads out of 5 tosses of an unbiased coin is :

- A** 5/6
- B** 5/8
- C** 5/12
- D** 5/16

Q31 Cards marked with numbers 2 to 105 are placed in a box and mixed. One card is chosen at random. The probability that the number on the card is less than 15 is

- A** 1/8
- B** 1/9
- C** 7/8
- D** 8/9

Q32 An urn contains 4 black, 5 white and 6 red balls. A ball is drawn at random. The probability that it is not black is

- A** 4/15
- B** 9/15
- C** 11/15
- D** 13/15

Q33 In a chess tournament, assume that your probability of winning a game is 0.3 against level 1 players, 0.4 against level 2 players and 0.5 against level 3 players. It is further assumed that among the players 50% are at level 1, 25 % are at level 2 and the remaining are at level 3. The probability of winning a game against a randomly chosen player is

- A** 0.275
- B** 0.375
- C** 0.225
- D** 0.325

Q34 A man repays a loan of Rs. 3250 by paying Rs. 20 in the first month and then increases the payment by Rs.15 every month. The number of months it takes to clear the loan is

- A** 20
- B** 25

C 35

D 40

Q35 The coefficient of x^3 in the expansion of $(x^2 - 2/x)^6$ is :

A -160

B -80

C -40

D 0

Q36 If the equation of the sphere through the circle $x^2 + y^2 + z^2 = 5$; $2x + 3y + 4z = 5$ and through the origin is $x^2 + y^2 + z^2 - 2x - 3y - 4z + C = 0$ then the value of C is

A 1

B -1

C 0

D 5

Q37 The equation of the plane containing the lines $(x+1)/3 = (y+3)/5 = (z+5)/7$ and $(x-2)/1 = (y-4)/3 = (z-6)/5$ is

A $x + 2y + z = 0$

B $x - 2y + z = 0$

C $x - 2y - z = 0$

D $x + 2y - z = 0$

Q38 Let $f(n) = \frac{1}{\sqrt{n^2}} + \frac{1}{\sqrt{n^2-1}} + \dots + \frac{1}{\sqrt{n^2-(n-1)^2}}$. Then $\lim_{n \rightarrow \infty} f(n)$ equals

A $\pi/4$

B $\pi/2$

C $/2$

D 0

Q39 A particle is acted upon by three forces in one plane, equal to $2, 2\sqrt{2}$ and 1 Kg forces respectively; the first is horizontal, the second acts at 45° to the horizontal and the third is vertical. Then the angle θ which the resultant makes with the positive x-axis is

A $\tan^{-1}(3/4)$

B $\tan^{-1}(4/3)$

C $\tan^{-1}(\sqrt{2}/4)$

D $\tan^{-1}(1)$

Q40 A block of mass 5 Kg starts to slide down a frictionless plane having an inclination of 25° from rest at the top. The length of the incline is 2 metre. Then its speed when it reaches the bottom of the incline is

- A** 4.1 m/s
- B** 6.3 m/s
- C** 7.1 m/s
- D** 9.3 m/s

BIOLOGY

1. By which of the following means Acquired immunodeficiency syndrome does not spread:
(A) Blood transfusion
(B) Sexual contact
(C) Using the same needle for injection
(D) Hand shake
2. Glycolysis operates in which part of cell
(A) Mitochondria (B) Chloroplast (C) Ribosome (D) Cytosol
3. Ribosomes of prokaryotes are:
(A) 80S type (B) 70S type (C) 60S type (D) 50S type
4. Five kingdom classification was proposed by
(A) R. H. Whittaker (B) Strassburger
(C) Klug and Cummings (D) Carolus Linnaeus
5. "Survival of the fittest" theory of evolution was proposed by
(A) Charles Darwin (B) Lamarck
(C) Hugo de Vries (D) None of the above
6. Site of the protein synthesis in cell is
(A) Cytosol (B) Ribosome (C) Nucleus (D) Chromosome
7. Light reaction of photosynthesis occurs in
(A) Chloroplast stroma (B) Thylakoid lumen
(C) Thylakoid membrane (D) Chloroplast inner membrane
8. Angiosperms first appeared in
(A) Jurassic period (B) Cretaceous period
(C) Triassic period (D) Permian period