BITSAT 2010 Question Paper

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1. If P represents radiation pressure, c represents speed of light and Q represents radiation energy striking a unit area per second, the non-zero integers x, y and z such that $P^xQ^yc^z$ is dimensionless, are:

(A) $x = 1, y = 1, z = -1$

(B) $x = 1, y = -1, z = -1$

(C) $x = -1, y = 1, z = 1$

(D) $x = 1, y = -1, z = 1$

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2. The position x of a particle varies with time t as $x = At^2 - Bt^3$. The acceleration at the time of the maximum velocity will be equal to zero. What is the value of t?

(A) $\frac{2A}{3B}$

(B) $\frac{A}{B}$

(C) $\frac{A}{3B}$

(D) zero

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3. Two projectiles A and B are thrown with the same speed but at angles 40° and 50° with the horizontal. Then

(A) A will fall earlier

(B) B will fall earlier

(C) both will fall at the same time

(D) None of these

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4. A body is travelling in a circle at a constant speed. It

(A) has a constant velocity

(B) is not accelerated

(C) has an inward radial acceleration

(D) has an outward radial acceleration

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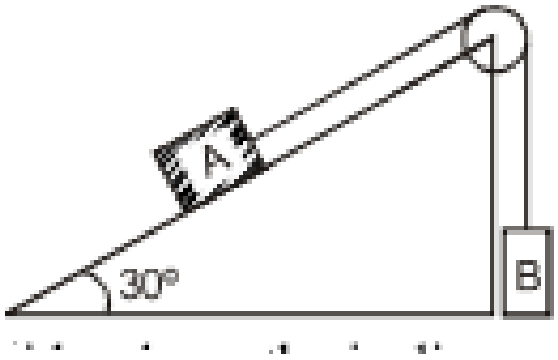
5. Two blocks are connected over a massless pulley as shown in figure. The mass of block A is 10 kg and the coefficient of kinetic friction is 0.2. Block A slides down the incline at constant speed. The mass of block B in kg is:



(A) 3.5

(B) 3.3

(C) 3.0

(D) 2.5

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6. A spring is compressed between two toy carts of mass m_1 and m_2. When the toys are released, the springs exert equal and opposite average forces for the same time on each cart. If v_1 and v_2 are the velocities of the toy carts and there is no friction between the toy carts and the ground, then:

(A) $v_1/v_2 = m_1/m_2$

(B) $v_1/v_2 = m_2/m_1$

(C) $v_1/v_2 = -m_1/m_2$

(D) $v_1/v_2 = -m_2/m_1$

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7. The potential energy for a force field is given by $U(x, y) = \cos(x + y)$. The force acting on a particle at position given by coordinates $(0, \pi/4)$ is:

(A) $\frac{1}{\sqrt{2}}(\hat{i} + \hat{j})$

(B) $-\frac{1}{\sqrt{2}}(\hat{i} + \hat{j})$

(C) $\left(\frac{1}{2}\hat{i} + \frac{\sqrt{3}}{2}\hat{j}\right)$

(D) $\left(\frac{1}{2}\hat{i} - \frac{\sqrt{3}}{2}\hat{j}\right)$

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8. A long string is stretched by 2 cm and the potential energy is V. If the spring is stretched by 10 cm, its potential energy will be

(A) $V/25$

(B) $V/5$

(C) $5V$

(D) $25V$

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9. The ratio of the accelerations for a solid sphere (mass m and radius R) rolling down an incline of angle θ without slipping and slipping down the incline without rolling is

(A) $5 : 7$

(B) $2 : 3$

(C) $2 : 5$

(D) $7 : 5$

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10. A system consists of three particles each of mass m and located at (1,1), (2,2) and (3,3). The coordinates of the centre of mass are

(A) (1,1)

(B) (2,2)

(C) (3,3)

(D) (6,6)

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11. Suppose the gravitational force varies inversely as the nth power of distance. Then the time period of a planet in circular orbit of radius R around the sun will be proportional to

(A) R^n

(B) $R^{\frac{n-1}{2}}$

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

(D) $R^{\frac{n-2}{2}}$

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12. Two planets A and B have the same material density. If the radius of A is twice that of B, then the ratio of the escape velocity v_A/v_B is

(A) 2

(B) $\sqrt{2}$

(C) $1/\sqrt{2}$

(D) 1/2

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13. The upper end of a wire of diameter 12 mm and length 1 m is clamped and its other end is twisted through an angle of $30°$. The angle of shear is

(A) $18°$

(B) $0.18°$

(C) $36°$

(D) $0.36°$

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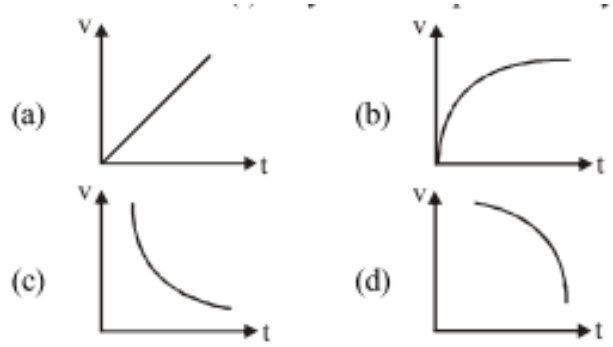
14. A spherical ball is dropped in a long column of viscous liquid. The speed v of the ball as a function of time t may be best represented by



(A) Option a

(B) Option b

(C) Option c

(D) Option d

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15. Two mercury drops (each of radius r) merge to form a bigger drop. The surface energy of the bigger drop, if the surface tension is T, is

(A) $25\pi r^2 T$

(B) $4\pi r^2 T$

(C) $2\pi r^2 T$

(D) $28\pi r^2 T$

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16. Two circular plates of radius 5 cm each have a 0.01 mm thick water film between them. What will be the force required to separate these plates? (Surface tension of water = 73 dyne/cm)

(A) 125 N

(B) 95 N

(C) 115 N

(D) 105 N

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17. One kilogram of ice at $0°$C is mixed with one kilogram of water at $80°$C. The final temperature of the mixture is (Take specific heat of water = 4200 J kg^{-1}K^{-1}, Latent heat of ice = 336 kJ kg^{-1})

(A) $0°$C

(B) $40°$C

(C) $50°$C

(D) $60°$C

---

18. In the equation $PV^{\gamma} =$ constant, the value of γ is unity. Then the process is

(A) isothermal

(B) adiabatic

(C) isobaric

(D) irreversible

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19. An ideal refrigerator has a freezer at a temperature of $130°$C. The coefficient of performance of the engine is 5. The temperature of the air (to which heat is rejected) is

(A) $320°$C

(B) $39°$C

(C) $325\,$K

(D) $325°$C

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20. 3 moles of an ideal gas at temperature $27°$C are mixed with 2 moles of an ideal gas at temperature $227°$C. Determine the equilibrium temperature of the mixture, assuming no loss of energy.

(A) $327°$C

(B) $107°$C

(C) $318°$C

(D) $410°$C

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21. A simple pendulum has time period T. Its time period in a lift which is moving upwards with acceleration $3\,$m s^{-2} is

(A) $t\sqrt{\dfrac{9.8}{12.8}}$

(B) $t\sqrt{\dfrac{12.8}{9.8}}$

(C) $t\sqrt{\dfrac{9.8}{6.8}}$

(D) $t\sqrt{\dfrac{6.8}{9.8}}$

---

22. A wave $y = a\sin(\omega t - kx)$ on a string meets with another wave producing a node at $x = 0$. Then the equation of the unknown wave is

(A) $y = a\sin(\omega t + kx)$

(B) $y = -a\sin(\omega t + kx)$

(C) $y = a\sin(\omega t - kx)$

(D) $y = -a\sin(\omega t - kx)$

---

23. A source has wavelength 60 cm when it is stationary. If the speed of sound in air is $320\,\mathrm{m\,s^{-1}}$ and the source moves with speed $20\,\mathrm{m\,s^{-1}}$, the wavelength in the forward direction will be

(A) 56 cm

(B) 60 cm

(C) 64 cm

(D) 68 cm

---

24. A charge $+q$ is at a distance $L/2$ above a square of side L. Then what is the flux linked with the surface?

(A) $\dfrac{q}{4\varepsilon_0}$

(B) $\dfrac{2q}{3\varepsilon_0}$

(C) $\dfrac{q}{6\varepsilon_0}$

(D) $\dfrac{6q}{\varepsilon_0}$

25. Two metallic spheres of radii 1 cm and 3 cm are given charges of -1×10^{-2} C and 5×10^{-2} C respectively. If these are connected by a conducting wire, the final charge on the bigger sphere is

(A) 2×10^{-2} C

(B) 3×10^{-2} C

(C) 4×10^{-2} C

(D) 1×10^{-2} C

---

26. In a region, the potential is represented by $V(x, y, z) = 6x - 8xy - 8y + 6yz$, where V is in volts and x, y, z are in metres. The electric force experienced by a charge of 2 coulomb situated at point $(1, 1, 1)$ is:

(A) $6\sqrt{5}$ N

(B) 30 N

(C) 24 N

(D) $4\sqrt{35}$ N

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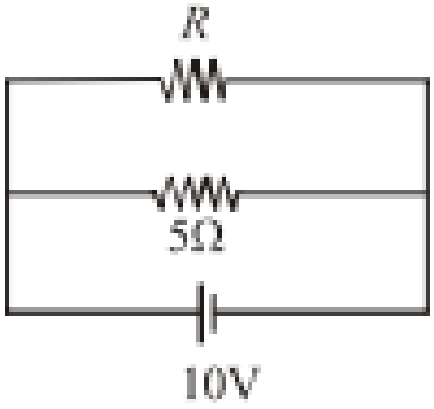
27. The power dissipated in the circuit shown in the figure is 30 W. The value of R is



(A) $20\,\Omega$

(B) $15\,\Omega$

(C) $10\,\Omega$

(D) $30\,\Omega$

28. Which of the following quantities does not change when a resistor connected to a battery is heated due to the current?

(A) Drift speed

(B) Resistivity

(C) Resistance

(D) Number of free electrons

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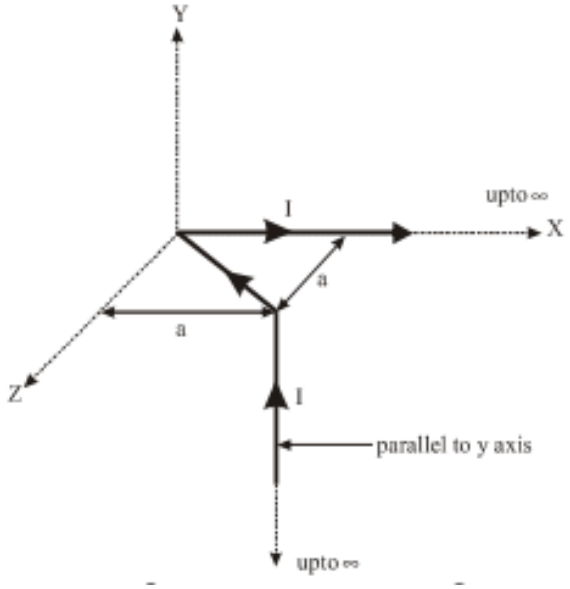
29. The magnetic field at the origin due to the current flowing in the wire shown is



(A) $-\frac{\mu_0 I}{8\pi a}(\hat{i}+\hat{k})$

(B) $\frac{\mu_0 I}{2\pi a}(\hat{i}+\hat{k})$

(C) $\frac{\mu_0 I}{8\pi a}(-\hat{i}+\hat{k})$

(D) $\frac{\mu_0 I}{4\pi a\sqrt{2}}(\hat{i}-\hat{k})$

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30. The back emf induced in a coil, when current changes from 1 ampere to zero in one milli-second, is 4 volts. The self inductance of the coil is

(A) 1 henry

(B) 4 henry

(C) 10^{-3} henry

(D) 4×10^{-3} henry

---

31. Two solenoids of same cross-sectional area have their lengths and number of turns in ratio of $1:2$. The ratio of self-inductance of two solenoids is

(A) $1:1$

(B) $1:2$

(C) $2:1$

(D) $1:4$

---

32. An alternating voltage $V = V_0 \sin \omega t$ is applied across a circuit. As a result, a current $I = I_0 \sin(\omega t - \pi/2)$ flows in it. The power consumed per cycle is

(A) zero

(B) $0.5 V_0 I_0$

(C) $0.707 V_0 I_0$

(D) $1.414 V_0 I_0$

---

33. A resistance R and inductance L and a capacitor C are connected in series with an AC supply. The resistance of R is $16\,\Omega$, inductive reactance $= 24\,\Omega$ and capacitive reactance $= 12\,\Omega$. If the current in the circuit is 5 A, find the potential difference across R, L and C.

(A) 30, 20, 50 volt

(B) 40, 100, 60 volt

(C) 70, 110, 60 volt

(D) 80, 120, 60 volt

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34. The diameter of the objective of a telescope is a, its magnifying power is m and wavelength of light is λ. The resolving power of the telescope is

(A) $(1.22\lambda)/a$

(B) $(1.22a)/\lambda$

(C) $\lambda m/(1.22a)$

(D) $a/(1.22\lambda)$

---

35. The photoelectric threshold of a metal is 2000Å. The energy of electrons ejected from the surface by ultraviolet light of wavelength 1500Å is

(A) 2.0 eV

(B) 1.5 eV

(C) 15 eV

(D) 150 eV

---

36. A material particle with a rest mass m_0 is moving with a velocity of light c. Then the wavelength of the de Broglie wave associated with it is

(A) h/m_0c

(B) zero

(C) ∞

(D) m_0c/h

---

37. Hydrogen atom in ground state is excited by a monochromatic radiation of $\lambda = 975$Å. Number of spectral lines in the resulting spectrum emitted will be

(A) 3

(B) 2

(C) 6

(D) 10

---

38. Which of the following is best nuclear fuel

(A) thorium 236

(B) plutonium 239

(C) uranium 236

(D) neptunium 239

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39. A transistor has a base current of 1 mA and emitter current 90 mA. The collector current will be

(A) 90 mA

(B) 1 mA

(C) 89 mA

(D) 91 mA

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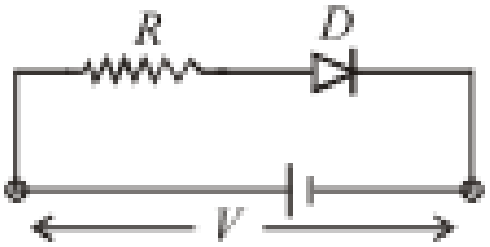
40. A d.c. battery of V volts is connected to a series combination of a resistor R and an ideal diode D as shown in the figure below. The potential difference across R will be



(A) $2V$ when diode is forward biased

(B) Zero when diode is forward biased

(C) V when diode is reverse biased

(D) V when diode is forward biased

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41. The vapour density of ozone is

(A) 16

(B) 32

(C) 24

(D) 48

42. In redox reaction 1 g-eq of reducing agent requires P g-eq of oxidising agent. The value of P is

(A) 1

(B) 2

(C) 3

(D) Depends on reaction

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43. Chloride ion and potassium ion are isoelectronic. Then

(A) Their sizes are same

(B) Cl^- ion is bigger than K^+ ion

(C) K^+ ion is relatively bigger

(D) Their sizes depend on other cation and anion

---

44. Which of the following pairs has both members from the same period of the periodic table

(A) Na, Ca

(B) Na, Cl

(C) Ca, Cl

(D) Cl, Br

---

45. In the periodic table, with the increase in atomic number, the metallic character of an element

(A) decreases in a period and increases in a group

(B) increases in a period and decreases in a group

(C) increases both in a period and the group

(D) decreases in a period and the group

---

46. Which of the following statements is/are true? 1. PH_3 and $BiCl_3$ do not exist. 2. $\pi - \pi$ bond is present in SO_2. 3. I_3^+ has bent geometry. 4. SeF_4 and CH_4 have same shape.

(A) 1, 2, 3

(B) 1, 3

(C) 1, 3, 4

(D) 1, 2, 4

---

47. When the temperature is raised, the viscosity of liquid decreases. This is because

(A) decreased volume of the solution

(B) increased attraction between molecules

(C) decreased covalent and hydrogen bond forces

(D) increase in temperature increases the average kinetic energy of molecules which overcomes the attractive force between them

---

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

(A) Monoatomic

(B) Diatomic

(C) Triatomic

(D) None of these

---

49. Which of these is least likely to act as Lewis base?

(A) F^-

(B) BF_3

(C) PF_3

(D) CO

---

50. The K_{sp} of CuS, Ag_2S and HgS are $10^{-44}, 10^{-31}, 10^{-54}$ respectively. The solubility order of these sulphides are in the order:

(A) $Ag_2S > CuS > HgS$

(B) $Ag_2S > HgS > CuS$

(C) $HgS > Ag_2S > CuS$

(D) $CuS > Ag_2S > HgS$

---

51. In which of the following reactions, H_2O_2 is acting as a reducing agent?

(A) $H_2O_2 + SO_2 \rightarrow H_2SO_4$

(B) $2KI + H_2O_2 \rightarrow 2KOH + I_2$

(C) $PbS + 4H_2O_2 \rightarrow PbSO_4 + 4H_2O$

(D) $Ag_2O + H_2O_2 \rightarrow 2Ag + H_2O + O_2$

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52. Sodium peroxide in contact with moist air turns white due to formation of:

(A) Na_2CO_3

(B) Na_2O

(C) NaOH

(D) $NaHCO_3$

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53. Which of the following is similar to graphite?

(A) B

(B) BN

(C) B_2H_6

(D) B_4C

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54. The number of geometrical isomers of CH_3–CH=CH–CH=CHCl is

(A) 2

(B) 4

(C) 6

(D) 8

---

55. According to IUPAC system, the correct name of the compound having the formula

$$CH_3 - C(CH_2) - CH_2 - CH_3$$

(A) 2-ethyl-3-methylbut-1-ene

(B) 2-methylpent-3-ene

(C) 2-methylbut-1-ene

(D) None of these

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56. Liebig's method is used for the estimation of

(A) Nitrogen

(B) Sulphur

(C) Carbon and hydrogen

(D) Halogens

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57. Hyperconjugation involves

(A) $\sigma - \pi$ conjugation

(B) $\sigma - \pi$ delocalisation

(C) No bond resonance

(D) All

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58. Name of the following reaction is

(A) Claisen condensation

(B) Diels–Alder reaction

(C) Dieckmann cyclisation

(D) Michael addition reaction

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59. The unsaturated hydrocarbon which on ozonolysis gives one mole each of formaldehyde, acetaldehyde and methyl glyoxal (CH_3COCHO) is

(A) CH_3–CH=C(CH_3)–CH_3

(B) CH_2=CH–CH_2–CH=CH_2

(C) CH_2=CH–C(CH_3)=CH–CH_3

(D) $(CH_3)_2$C=CH–CH_3

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60. Minamata disease is due to pollution of

(A) arsenic into the atmosphere

(B) organic waste into drinking water

(C) oil spill in water

(D) industrial waste mercury into fishing water

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61. Phosphate pollution is caused by

(A) Sewage and agricultural fertilizers

(B) Weathering of phosphate rocks only

(C) Agricultural fertilizers only

(D) Phosphate rocks and sewage

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62. Eutrophication causes reduction in

(A) Dissolved oxygen

(B) Nutrients

(C) Dissolved salts

(D) All of these

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63. Coolant used in radiator is aqueous solution of ethylene glycol. In order to prevent the solution from freezing at -0.3°C, how much ethylene glycol must be added to 5 kg of water? ($K_f = 1.86$ K kg mol^{-1})

(A) 50 g

(B) 55 g

(C) 45 g

(D) 40 g

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64. Which of the following will form the cathode with respect to iron an electrode cell?

(A) Mg

(B) Al

(C) Cu

(D) Zn

---

65. The activation energy for a simple chemical reaction A $\rightarrow$ B is E_a in the forward direction. The activation energy for reverse reaction

(A) is always less than E_a

(B) can be less than or more than E_a

(C) is always double of E_a

(D) is negative of E_a

---

66. The following data are for the decomposition of ammonium nitrite in aqueous solution:

Vol. of N_2 in cc	Time (min)
6.25	10
9.00	15
11.40	20
13.65	25
35.65	∞

The order of reaction is:

(A) Zero

(B) One

(C) Two

(D) Three

---

67. Which liberates ammonia when treated with water?

(A) Li_3N

(B) Mg_3N_2

(C) $CaCN_2$

(D) All

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68. The correct order of reactivity of halogens with alkalis is

(A) F > Cl > Br > I

(B) F < Cl > Br < I

(C) F < Cl < Br < I

(D) F < Cl < Br > I

---

69. In the manufacture of iron from haematite, limestone is added to act as

(A) Flux

(B) Slag

(C) A reducing agent

(D) An oxidizing agent

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70. Which of the following has square planar geometry?

(A) $[PtCl_4]^{2-}$

(B) $[NiCl_4]^{2-}$

(C) $[ZnCl_4]^{2-}$

(D) $[CoCl_4]^{2-}$

---

71. In which of the following conversions, phosphorus pentachloride is used as the reagent?

(A) $H_2C{=}CH_2 \rightarrow CH_3CH_2Cl$

(B) $CH_3CH_2OH \rightarrow CH_3CH_2Cl$

(C) $H_3C{-}O{-}CH_3 \rightarrow CH_3Cl$

(D) $CH{\equiv}CH \rightarrow CH_2{=}CHCl$

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72. Match List I (Reaction) with List II (Reagent) and select the correct answer.

List I	List II
I. Etard reaction	A. Alcoholic KOH
II. Hydroxylation	B. Anhydrous $AlCl_3$
III. Dehydrohalogenation	C. Chromyl chloride
IV. Friedel–Crafts reaction	D. Dilute alkaline $KMnO_4$

(A) I-A, II-B, III-C, IV-D

(B) I-D, II-C, III-A, IV-B

(C) I-C, II-D, III-A, IV-B

(D) I-B, II-A, III-D, IV-C

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73. Which of the following will *not* form a yellow precipitate on heating with an alkaline solution of iodine?

(A) $CH_3CH(OH)CH_3$

(B) $CH_3CH_2CH(OH)CH_3$

(C) CH_3OH

(D) CH_3CH_2OH

---

74. Formic acid and acetic acid can be distinguished by

(A) phenyl hydrazine

(B) $NaHCO_3$

(C) Tollen's reagent

(D) none of these

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75. When ethylamine reacts with sodium metal, the gas evolved is

(A) H_2

(B) C_2H_5

(C) N_2

(D) NH_3

---

76. The secondary structure of a protein refers to

(A) the fixed configuration of the polypeptide backbone

(B) α-helical backbone

(C) hydrophobic interactions

(D) sequence of α-amino acids

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77. When H_2S gas is passed through the HCl containing aqueous solution of $CuCl_2$, $HgCl_2$, $BiCl_3$ and $CoCl_2$, it does not precipitate out

(A) CuS

(B) HgS

(C) Bi_2S_3

(D) CoS

---

78. Which one of the following statements is correct?

(A) From a mixed precipitate of AgCl and AgI, ammonia solution dissolves only AgCl.

(B) Ferric ions give a deep green precipitate on adding potassium ferrocyanide.

(C) On boiling a solution having K^+, Ca^{2+} and HCO_3^- ions we get a precipitate of $K_2Ca(CO_3)_2$.

(D) Manganese salts give a violet borax bead test in the reducing flame.

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79. Three separate samples of a solution of a single salt gave these results. One formed a white precipitate with excess ammonia solution, one formed a white precipitate with dil. HCl solution and one formed a black precipitate with H_2S. The salt could be

(A) $AgNO_3$

(B) $Pb(NO_3)_2$

(C) $Hg(NO_3)_2$

(D) $MnSO_4$

---

80. Experiment to study kinetics of the dissociation of hydrogen peroxide must be performed by group of two or three so that

(A) when one is recording data other should be swirling flask at constant rate

(B) experiment can be performed by one student only as outcomes are independent on rate of mixing of mixture 1 and 3.

(C) for safety purpose

(D) none of these

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81. Let $A = \{x : x \in \mathbb{R}, |x| < 1\}$; $B = \{x : x \in \mathbb{R}, |x - 1| \geq 1\}$ and $A \cup B = \mathbb{R} - D$, then the set D is

(A) $\{x : 1 < x \leq 2\}$

(B) $\{x : 1 \leq x < 2\}$

(C) $\{x : x \leq 2\}$

(D) None of these

---

82. If $12\cot^2\theta - 31\cos\theta + 32 = 0$, then the value of $\sin\theta$ is

(A) $\frac{3}{5}$ or 1

(B) $\frac{2}{3}$ or $-\frac{2}{3}$

(C) $\frac{4}{5}$ or $\frac{3}{4}$

(D) $\pm\frac{1}{2}$

---

83. $\tan 20^\circ + \tan 40^\circ + \sqrt{3}\tan 20^\circ \tan 40^\circ$ is equal to

(A) $\sqrt{3}/2$

(B) $\sqrt{3}/4$

(C) $\sqrt{3}$

(D) 1

---

84. The roots of the equation $x^2 - 2\sqrt{2}x + 1 = 0$ are

(A) Real and different

(B) Imaginary and different

(C) Real and equal

(D) Rational and different

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85. If $\dfrac{1 - i\alpha}{1 + i\alpha} = A + iB$, then $A^2 + B^2$ equals

(A) 1

(B) α^2

(C) -1

(D) $-\alpha^2$

---

86. In a polygon no three diagonals are concurrent. If the total number of points of intersection of diagonals interior to the polygon be 70, then the number of diagonals of the polygon is

(A) 20

(B) 28

(C) 8

(D) None of these

---

87. With 17 consonants and 5 vowels, the number of words of four letters that can be formed having two different vowels in the middle and one consonant, repeated or different at each end is

(A) 5780

(B) 2890

(C) 5440

(D) 2720

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88. The coefficient of x^{32} in the expansion of $\left(x^4 - \frac{1}{x^3}\right)^{15}$ is

(A) $-15C_3$

(B) $15C_4$

(C) $-15C_2$

(D) $15C_5$

---

89. If arithmetic means are inserted between 1 and 31 so that the ratio of the 7th and $(m-1)$th means is $5:9$, then find the value of m.

(A) 14

(B) 24

(C) 10

(D) 20

---

90. The reflection of the point $(4, -13)$ in the line $5x + y + 6 = 0$ is

(A) $(-1, -14)$

(B) $(3, 4)$

(C) $(1, 2)$

(D) $(-4, 13)$

---

91. If the equations of the opposite sides of a parallelogram are $x^2 - 5x + 6 = 0$ and $y^2 - 6y + 5 = 0$, then equations of its diagonals are

(A) $x + 4y = 13,\ y = 4x - 7$

(B) $4x + y = 13,\ 4y = x - 7$

(C) $4x + y = 13,\ y = 4x - 7$

(D) $y - 4x = 13,\ 4x + y = 7$

---

92. If the line $2x - 1 = 0$ is the directrix of the parabola $y^2 - kx + 6 = 0$, then one of the values of k is

(A) -6

(B) 6

(C) $1/4$

(D) $-1/4$

---

93. The line $ax + by = 1$ cuts ellipse $cx^2 + dy^2 = 1$ only once if

(A) $ca^2 + db^2 = 1$

(B) $\frac{c}{a^2} + \frac{d}{b^2} = 1$

(C) $\frac{a^2}{c} + \frac{b^2}{d} = 1$

(D) $a^2c + b^2d = 1$

94. Find the equation of chord of the circle $x^2 + y^2 = 8x$ bisected at the point $(4, 3)$.

(A) $y = 3$

(B) $y = 1$

(C) $y = 6$

(D) $y = 7$

---

95. Find the value of $\lim_{x \to 0} \frac{\sqrt{1+x^2} - \sqrt{1-x^2}}{x^2}$.

(A) 1

(B) 2

(C) 3

(D) 5

---

96. Mean of 25 observations was found to be 78.4. But later it was found that 96 was misread as 69. The correct mean is

(A) 79.24

(B) 79.48

(C) 80.10

(D) None of these

---

97. If the mean, mode and S.D. of a frequency distribution are 41.45 and 8 respectively, then its Pearson's coefficient of skewness is

(A) $\frac{1}{3}$

(B) $-\frac{1}{2}$

(C) $\frac{2}{3}$

(D) 1

---

98. A black die and a white die are rolled. Find the probability that the number shown by the black die will be more than twice that shown by the white die.

(A) $\frac{1}{8}$

(B) $\frac{1}{6}$

(C) $\frac{1}{3}$

(D) $\frac{1}{4}$

---

99. Let $E = \{1, 2, 3, 4\}$ and $F = \{1, 2\}$. Then the number of onto functions from E to F is

(A) 14

(B) 16

(C) 12

(D) 8

---

100. If $f(x) = \frac{x}{\sqrt{1+x^2}}$, then $(f \circ f)(x)$ is

(A) $\frac{3x}{\sqrt{1+x^2}}$

(B) $\frac{x}{\sqrt{1+3x^2}}$

(C) $\frac{3x}{\sqrt{1-x^2}}$

(D) None of these

---

101. The value of $\cos^{-1} x + \cos^{-1}\left(\frac{x}{2} + \frac{1}{2}\sqrt{3-3x^2}\right)$; $\frac{1}{2} \leq x \leq 1$ is

(A) $-\frac{\pi}{3}$

(B) $\frac{\pi}{3}$

(C) $\frac{3}{\pi}$

(D) $-\frac{3}{\pi}$

---

102. If $A = \begin{bmatrix} 1 & 3 \\ 3 & 2 \\ 2 & 5 \end{bmatrix}$ **and** $B = \begin{bmatrix} -1 & -2 \\ 0 & 5 \\ 3 & 1 \end{bmatrix}$ **and** $A + B - D = 0$ **(zero matrix), then** D **matrix will be**

(A) $\begin{bmatrix} 0 & 2 \\ 3 & 7 \\ 6 & 5 \end{bmatrix}$

(B) $\begin{bmatrix} 0 & 2 \\ 3 & 7 \\ 5 & 6 \end{bmatrix}$

(C) $\begin{bmatrix} 0 & 1 \\ 3 & 7 \\ 5 & 6 \end{bmatrix}$

(D) $\begin{bmatrix} 0 & -2 \\ -3 & -7 \\ -5 & -6 \end{bmatrix}$

---

103. The value of

$$\begin{vmatrix} 1 & 2 & 3 \\ -4 & 3 & 6 \\ 2 & -7 & 9 \end{vmatrix}$$

is

(A) 213

(B) -231

(C) 231

(D) 39

---

104. Let $f(x) = \begin{cases} ax^2 + 1, & x > 1 \\ x + a, & x \leq 1 \end{cases}$ **Then** $f(x)$ **is derivable at** $x = 1$**, if**

(A) $a = 2$

(B) $a = 1$

(C) $a = 0$

(D) $a = \frac{1}{2}$

---

105. If a circular plate is heated uniformly, its area expands $3c$ **times as fast as its radius, then the value of** c **when the radius is 6 units, is**

(A) 4π

(B) 2π

(C) 6π

(D) 3π

---

106. The function $f(x) = \tan x - 4x$ **is strictly decreasing on**

(A) $\left(-\frac{\pi}{3}, \frac{\pi}{3}\right)$

(B) $\left(\frac{\pi}{3}, \frac{\pi}{2}\right)$

(C) $\left(-\frac{\pi}{3}, \frac{\pi}{2}\right)$

(D) $\left(\frac{\pi}{2}, \pi\right)$

---

107. The slope of the tangent to the hyperbola $2x^2 - 3y^2 = 6$ **at** $(3, 2)$ **is**

(A) -1

(B) 1

(C) 0

(D) 2

---

108. $\int 4\cos\left(x + \frac{\pi}{6}\right)\cos 2x \cos\left(\frac{5\pi}{6} + x\right)\, dx$

(A) $-\left(x+\frac{\sin 4x}{4}-\frac{\sin 2x}{2}\right)+C$

(B) $-\left(x+\frac{\sin 4x}{4}+\frac{\sin 2x}{2}\right)+C$

(C) $-\left(x-\frac{\sin 4x}{4}+\frac{\sin 2x}{2}\right)+C$

(D) $-\left(x-\frac{\sin 4x}{4}+\frac{\cos 2x}{2}\right)+C$

---

109. If $I_m=\int_0^1 (\ln x)^m dx$, where $m\in\mathbb{N}$, then $I_{10}+10I_9$ is equal to

(A) e^{10}

(B) $\frac{e^{10}}{10}$

(C) e

(D) $e-1$

---

110. The area of the region bounded by the curve $y=x|x|$, x-axis and the ordinates $x=1, x=-1$ is given by

(A) zero

(B) $\frac{1}{3}$

(C) $\frac{2}{3}$

(D) 1

---

111. What is the solution of $\frac{dy}{dx}+2y=1$ satisfying $y(0)=0$?

(A) $y=\frac{1-e^{-2x}}{2}$

(B) $y=\frac{1+e^{-2x}}{2}$

(C) $y=1+e^{2x}$

(D) $y=\frac{1+e^{x}}{2}$

---

112. The solution of differential equation $2x\frac{dy}{dx}-y=3$ represents a family of

(A) circles

(B) straight lines

(C) ellipses

(D) parabola

---

113. If $(\vec{a} \times \vec{b})^2 + (\vec{a} \cdot \vec{b})^2 = 676$ and $|\vec{b}| = 2$, then $|\vec{a}|$ is equal to

(A) 13

(B) 26

(C) 39

(D) None of these

---

114. Which one of the following is the unit vector perpendicular to both $\vec{a} = -\hat{i} + \hat{j} + \hat{k}$ and $\vec{b} = \hat{i} - \hat{j} + \hat{k}$?

(A) $\frac{\hat{i} + \hat{j}}{\sqrt{2}}$

(B) $\hat{k}$

(C) $\frac{\hat{j} + \hat{k}}{\sqrt{2}}$

(D) $\frac{\hat{i} - \hat{j}}{\sqrt{2}}$

---

115. With respect to a rectangular Cartesian coordinate system, three vectors are expressed as $\vec{a} = 4\hat{i} - \hat{j},\ \vec{b} = -3\hat{i} + 2\hat{j}$ and $\vec{c} = -\hat{k}$. The unit vector along the direction of sum of these vectors is

(A) $\frac{1}{\sqrt{3}}(\hat{i} + \hat{j} - \hat{k})$

(B) $\frac{1}{\sqrt{2}}(\hat{i} + \hat{j} - \hat{k})$

(C) $\frac{1}{3}(\hat{i} - \hat{j} + \hat{k})$

(D) $\frac{1}{\sqrt{2}}(\hat{i} + \hat{j} + \hat{k})$

---

116. If the midpoints of sides BC, CA, AB of triangle ABC are respectively D, E, F, then position vector of centre of triangle DEF, when position vectors of A, B, C are respectively $\hat{i}+\hat{j},\ \hat{j}+\hat{k},\ \hat{k}+\hat{i}$, is

(A) $\frac{1}{3}(\hat{i}+\hat{j}+\hat{k})$

(B) $(\hat{i}+\hat{j}+\hat{k})$

(C) $2(\hat{i}+\hat{j}+\hat{k})$

(D) $\frac{2}{3}(\hat{i}+\hat{j}+\hat{k})$

---

117. The perpendicular distance of point $P(1,2,3)$ from the line $\frac{x-6}{3}=\frac{y-7}{2}=\frac{z-7}{-2}$ is

(A) 7

(B) 5

(C) 0

(D) 6

---

118. The equation of the plane containing the line $\frac{x-x_1}{\ell}=\frac{y-y_1}{m}=\frac{z-z_1}{n}$ is $a(x-x_1)+b(y-y_1)+c(z-z_1)=0$, then

(A) $a\ell+bm+cz_1=0$

(B) $a\ell+bm+cn=0$

(C) $\frac{a}{\ell}=\frac{b}{m}=\frac{c}{n}$

(D) $\ell x_1+my_1+nz_1=0$

---

119. If mean of a Poisson distribution of a random variable X is 2, then the value of $P(X>1.5)$ is

(A) $\frac{3}{e^2}$

(B) $\frac{3}{e}$

(C) $1-\frac{3}{e}$

(D) $1-\frac{3}{e^2}$

120. If $P(A \cup B) = \frac{2}{3},\ P(A \cap B) = \frac{1}{6}$ and $P(A) = \frac{1}{3}$, then

(A) A and B are independent events

(B) A and B are disjoint events

(C) A and B are dependent events

(D) None of these

---

121. A flagstaff of 6 metres high placed on the top of a tower throws a shadow of $2\sqrt{3}$ metres along the ground, when the angle (in degrees) which the sun makes with the ground is

(A) 60°

(B) 80°

(C) 75°

(D) None of these

---

122. A wholesale merchant wants to start the business of cereal with 24000. Wheat is 400 per quintal and rice is 600 per quintal. He has capacity to store 200 quintal cereal. He earns the profit 25 per quintal on wheat and 40 per quintal on rice. If he stores x quintal rice and y quintal wheat, then maximum profit is the objective function

(A) $25x + 40y$

(B) $40x + 25y$

(C) $400x + 600y$

(D) $\frac{40x}{25} + \frac{600}{25}y$

---

123. The minimum value of $\frac{x^4 + y^4 + z^4}{xyz}$ for positive real numbers x, y, z is

(A) $\sqrt{2}$

(B) $2\sqrt{2}$

(C) $4\sqrt{2}$

(D) $8\sqrt{2}$

---

124. Let $f(x) = \dfrac{(e^x - 1)^2}{\sin\left(\dfrac{x}{a}\right)\log\left(1 + \dfrac{x}{4}\right)}$ **for** $x \neq 0$**, and** $f(0) = 12$**. If** $f(x)$ **is continuous at** $x = 0$**, then the value of** a **is**

(A) 1

(B) -1

(C) 2

(D) 3

---

125. Which of the following functions is differentiable at $x = 0$**?**

(A) $\cos(|x|) + |x|$

(B) $\cos(|x|) - |x|$

(C) $\sin(|x|) + |x|$

(D) $\sin(|x|) - |x|$

---

126. Despite being in the career of singing for the last 10 yr, he has not been able to earn fame on account of his *practice of borrowing ideas and words from others and using them as his own*.

(A) adaptation

(B) pantomime

(C) imitation

(D) plagiarism

---

127. Every person is not allowed to enter the place *where public, government or historical records are kept*.

(A) scullery

(B) pantry

(C) archives

(D) coffer

---

128. The advertisement assured the public that the medicine would give back to the users, their *youthful vigour and appearance*.

(A) rejuvenate

(B) restore

(C) replenish

(D) render

---

129. Choose the alternative which is most similar in meaning to the word given in capital letters. PARAMOUR

(A) Lover

(B) Companion

(C) Friend

(D) Rival

---

130. Choose the alternative which is most similar in meaning to the word given in capital letters. REFECTORY

(A) Dining Room

(B) Parlour

(C) Living Room

(D) Restaurant

---

131. Choose the alternative which is most similar in meaning to the word given in capital letters. ASSENT

(A) Compromise

(B) Judgement

(C) Agreement

(D) Expression

---

132. Choose the alternative which expresses the meaning of the given idiom/phrase. To show one's teeth

(A) To ridicule

(B) To face difficulties

(C) To adopt a threatening attitude

(D) To be humble

---

133. Choose the alternative which expresses the meaning of the given idiom/phrase. To pour oil in troubled water

(A) To foment trouble

(B) To add to the trouble

(C) To instigate

(D) To calm a quarrel with soothing words

---

134. Which sentence should come second in the paragraph?

(A) B

(B) A

(C) F

(D) E

---

135. Which sentence should come before the last?

(A) F

(B) E

(C) D

(D) A

---

136. Which sentence will come complete the passage?

(A) C

(B) A

(C) D

(D) B

---

137. Which sentence will come third after the rearrangement?

(A) F

(B) E

(C) B

(D) D

---

138. Which sentence will start the passage?

(A) F

(B) C

(C) E

(D) B

---

139. A novel of real _____ must invent its own language, and this one does.

(A) impulsive

(B) ambition

(C) intricate

(D) abstruse

---

140. Information technology, and the hardware and software _____ with the IT industry.

(A) amalgamation

(B) associated

(C) regulated

(D) use

---

141. EFLK : MOR ::

(A) EFJK

(B) STXY

(C) KJFE

(D) YXTS

---

142. Mahatma Gandhi : Porbandar :: Pt. Jawaharlal Nehru : ?

(A) Allahabad

(B) Calcutta

(C) New Delhi

(D) Mumbai

---

143. Statement: The education of a student at collegiate level, not taking into account maintenance expenses, costs four hundred rupees a year. Collegiate education is thus drawing heavily upon national resources of an impoverished community. So college education should be restricted to a brilliant few.

Assumptions: I. Our resources are very limited. II. Only a few students should be admitted to the colleges.

(A) Only assumption I is implicit

(B) Only assumption II is implicit

(C) Neither I nor II is implicit

(D) Both I and II are implicit

---

144. In a code language, if BANGED is coded as JJKQCC, then the word STRAY will be coded as

(A) DEUTV

(B) DEUVT

(C) EFVWT

(D) EFVVS

---

145. 2, 3, 7, 22, 155, ?

(A) 1706

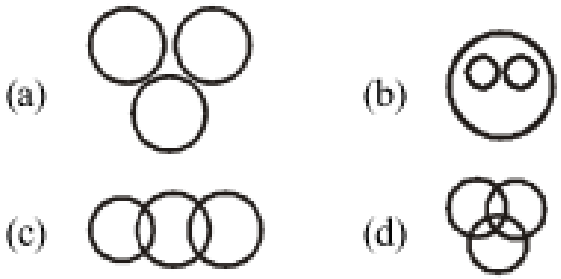
(B) 1550

(C) 3411

(D) 3100

---

146. Which one of the following diagram represents the correct relationship among Colour, Black and White.



(A) Option a

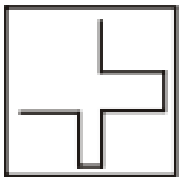
(B) Option b

(C) Option c

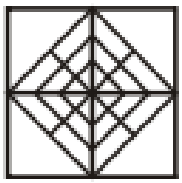
(D) Option d

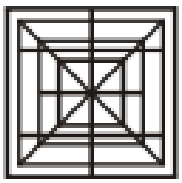
---

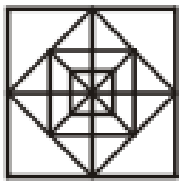
147. Find out the alternative figure which contains figure (X) as its part.

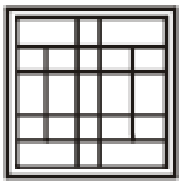


(X)

(a) 

(b) 

(c) 

(d) 

(A) Option a

(B) Option b

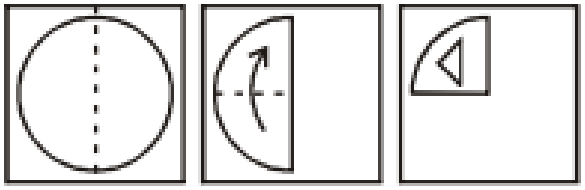
(C) Option c

(D) Option d

---

148. A piece of paper is folded and cut. From the figures given, indicate how it will appear when opened.

Question figures:



Answer figures:

(a)  (b) 

(c)  (d) 

(A) Option a

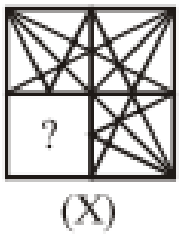
(B) Option b

(C) Option c

(D) Option d

---

149. Identify the figure that completes the pattern.



(a)  (b) 

(c)  (d) 

(A) Option a

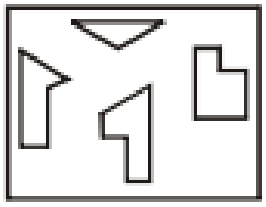
(B) Option b

(C) Option c

(D) Option d

---

150. Find out which of the figures (a), (b), (c) and (d) can be formed from the pieces given in figure (X).

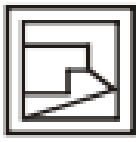


(X)

(a) 

(b) 

(c) 

(d) 

(A) Option a

(B) Option b

(C) Option c

(D) Option d
