#### **AIEEE - 2002**

## Physics and Chemistry Solutions

2. 
$$\lambda_{\text{max}}/2 = 40 \Rightarrow \lambda_{\text{max}} = 80$$

- Large aperture increases the amount of light gathered by the telescope increasing the resolution.
- $KE = \frac{1}{2}mv_{esc}^2 = \frac{1}{2}m(\sqrt{2gR})^2 = mgR$ 5.
- A voltmeter is a high resistance galvanometer and is connected in parallel to circuit an 6. is a low resistance galvanometer so if we connect high resistance in series with a resistance will be much high.
- In coil A, B =  $\frac{\mu_0}{4\pi} \frac{2\pi I}{R}$ .  $\therefore B\alpha \frac{I}{R}$ ; Hence,  $\frac{B_1}{B_2} = \frac{I_1}{R_1} \cdot \frac{R_2}{I_2} = \frac{2}{2} = 1$
- No. of images,  $n = (360/\theta) 1$ . As  $\theta = 60^{\circ}$  so n = 5
- 9.  $P_1 = V^2/R$ ;  $P_2 = \frac{V^2}{(R/2)} + \frac{V^2}{(R/2)} = 4\frac{V^2}{R} = 4P_1$
- 10.  $E_n = -\frac{13.6}{n^2} \Rightarrow E_2 = -\frac{13.6}{2^2} = 3.4eV$
- 11.  $\frac{\lambda_A}{\lambda_B} = \frac{1}{2} \Rightarrow \frac{n_A}{n_B} = \frac{2}{1}$
- The fact that placing wax the frequency of the unknown fork and also the beat frequency states that the sknown fork is of higher frequency. n - 288 = 4  $\Rightarrow$  n = 292 cm.

19

$$n - 288 = 4 \Rightarrow n = 292 \text{ cm}$$

- 13.  $y_1 + y_2 = a \sin(\omega kx) a \sin(\omega t + kx)$  $= -2a \cos \alpha t \times \sin x \Rightarrow y_1 + y_2 = 0 \text{ at } x = 0$
- r = 2/20 = 0.1 V

s work done in moving charge q from point A to B

- g is same for both
- maximum and P.E minimum at mean position
- gular momentum = conserved

$$\frac{1}{2}MR^2\omega_{_1} = 2mR^2\omega + \frac{1}{2}MR^2\omega \Rightarrow \omega = \frac{M\omega_{_1}}{M+4m}$$

- The condition to avoid skidding,  $v = \sqrt{\mu rg} = \sqrt{0.6 \times 150 \times 10} = 30 \text{ m/s}$
- $v = \sqrt{2gh} = \sqrt{2 \times 10 \times 20} = 20 \text{ m/s}$

$$20. \quad W = \int_{x_1}^{x_2} F dx = \int_{x_1}^{x_2} Kx dx = K \left[ \frac{x^2}{2} \right]_{x_1}^{x_2} = \frac{K}{2} [x_2^2 - x_1^2] = \frac{800}{2} [(0.15)^2 - (0.05)^2] = 8J$$

- 21. Conserving Linear Momentum  $2Mv_c = 2Mv Mv \Rightarrow v_c = v/2$
- 22. It will compress due to the force of attraction between two adjacent coils carrying current in the same direction
- 24. Semiconductors are insulators at low temperature
- 27. Neutrons can't be deflected by a magnetic field

28. 
$$hc/\lambda_0 = W_0$$
;  $\frac{(\lambda_0)_1}{(\lambda_0)_2} = \frac{(W_0)_2}{(W_0)_1} = \frac{4.5}{2.3} = 2:1$ 

- 29. Covalent bond formation is best explained by orbital theory which uses vave henomena
- 32. Amount left =  $N_0/2^n = N_0/8$  (Here n = 15/5 = 3)

33. Use 
$$R_t = R_0 \left( \frac{T}{273} \right)$$

34. 
$$E = \sum \frac{1}{2}CV^2 = \frac{1}{2}nCV^2$$

- 35. Black body also emits radiation whereas of thin, escapes a black hole.
- 36. The given circuit clearly shows that the industors are in parallel we have,  $\frac{1}{L} = \frac{1}{3} + \frac{1}{3} + \frac{1}{3}$  or L = 1
- 37. As the velocity at the highest point educes to zero. The K.E. of the ball also becomes zero.
- 38. As the ball moves down from high. h' to ground the P.E at height 'h' is converted to K.E. at the ground (Applying Law of conselvation of Energy)

Hence, 
$$\frac{1}{2}m_{_A}v_{_A}^2$$
  $m_{_A}gh_{_A}$  or  $v_{_A}=\sqrt{2gh_{_A}}$  ; Similarly,  $v_{_B}=\sqrt{2gh}$  or  $v_{_A}=v_{_B}$ 

39. Let the in that ve ochy of the body be v. Hence the final velocity = v/2

Applying 
$$v = u^2 - 2as \Rightarrow \left(\frac{v}{2}\right)^2 = v^2 - 2.a.3 \Rightarrow a = v^2 / 8$$

In  $V^{\dagger}$  case when the body comes to rest, final velocity = 0, initial velocity =  $\frac{v}{2}$ 

Again, 
$$(0)^2 = \left(\frac{v}{2}\right)^2 - 2.\frac{v^2}{8}.s$$
; or  $s = 1cm$ 

So the extra penetration will be 1 cm

- 40. When gravitational force becomes zero so centripetal force on satellite becomes zero so satellite will escape its round orbit and becomes stationary.
- 41. The molecular kinetic energy increases, and so temperature increases.
- 43. Because thermal energy decreases, therefore mass should increase

Maximum in insulators and overlapping in metals

46. 
$$E = (PE)_{final} - (PE)_{initial} = \frac{-GMm}{3R} + \frac{GMm}{R} = \frac{GMm}{6R}$$

Spring constant becomes n times for each piece.  $T=2\pi\sqrt{m/k}$ 

$$\frac{T_1}{T_2} = \frac{\sqrt{nK}}{K} \text{ or } T_2 = T/\sqrt{n}$$

The flux for both the charges exactly cancels the effect of each other

49. 
$$W = \frac{V^2}{R_{col}}$$
;  $150 = \frac{(15)^2}{R} + \frac{(15)^2}{2} \Rightarrow R = 6\Omega$ 

50. Resolving power 
$$\alpha(1/\lambda)$$
. Hence,  $\frac{(R.P)_1}{(R.P)_2} = \frac{\lambda_2}{\lambda_1} = \frac{5}{4}$ 

- $T=2\pi\sqrt{I_{\mbox{\tiny eff}}/8}~$  ;  $~I_{\mbox{\tiny eff}}~$  decreases when the child stands up 51.
- Man in the lift is in a non inertial frame so we have to talk into account the pseudo acceleration 52.
- From Faradays law of electrolysis,  $m \propto it$ . 53.

54. 
$$v_{rms} \alpha \sqrt{T/m}$$
 ;  $\sqrt{\frac{273+47}{32}} = \sqrt{\frac{T}{2}} \alpha^{-1} = 20$ 

55.  $T = 2\pi m/Bq$ 

57. 
$$I_1N_1 = I_2N_2 \Rightarrow I_2 = \frac{4 \times 140}{280} = 2A$$

- Absolute zero temperature is practically not reachable Resultant of  $\rm F_2$  and  $\rm F_3$  is a magnitude  $\rm F_1$ .

61. Use 
$$\tan \alpha = \frac{P \sin \theta}{P \cos \theta} \Rightarrow \tan 90^{\circ} = \frac{P \sin \theta}{Q + P \cos \theta} = \infty$$
  $\therefore Q + P \cos \theta = 0 \Rightarrow P \cos \theta = -Q$ 

$$R = \sqrt{P^2 + Q^2 + 2PQ\cos\theta} \ R = \sqrt{P^2 + Q^2 - 2Q^2} \ or \ R = \sqrt{P^2 - Q^2} = 12$$

1/4 (P + Q) (P - Q) or P - Q = 144/18 = 8 
$$\therefore$$
 P = 13 N and Q = 5 N

 $u^2 = 2as$ . a is same for both cases

$$2$$
/2a;  $s_2 = 16 u^2 / 2a = 16 s_1 \Rightarrow s_1 : s_2 = 1 : 16$ 

- 63.  $\gamma$  for resulting mixture should be in between 7/5 and 5/3
- 64. Apply the condition for equilibrium of each charge

65. 
$$4\pi \in {}_{0} R = 1.1 \times 10^{-10}$$

66. 
$$a = \frac{m_1 - m_2}{m_1 + m_2}g$$
;  $\frac{1}{8} = \frac{m_1 - m_2}{m_1 + m_2} \Rightarrow m_1: m_2 = 9:7$ 

- 67. Energy radiated  $\alpha R^2T^4$
- 68. Apply Newton's second law

$$F - T_{ab} = ma$$
;  $T_{ab} - T_{bc} = ma$   $\therefore T_{bc} = 7.8 \text{ N}$ 

- 69. T 60 g = 60 a; T = 3000 N;  $\therefore a = 4 ms^{-2}$
- 70. Zero, line of motion through the point P.
- 72.  $v_{esc} = \sqrt{2gR}$ , where R is radius of the planet

Hence escape velocity is independent of m

- 73.  $\beta$  rays are the beam of fast moving electrons
- 74. Both have the dimension M<sup>1</sup>L<sup>2</sup>T<sup>-2</sup>
- 80. The nitro group can attach to metal through nitrogen as (-NO<sub>2</sub>) or through ox igen as nitrito (-ONO)
- 81. CH<sub>3</sub> group has + I effect, as number of CH<sub>3</sub> group increases, the inductive of fect increases.
- 82. Bond between C of organic molecule and metal atom.
- 84. (HSO<sub>4</sub>) can accept and donate a proton

$$(HSO_4)^{-} + H^{+} \rightarrow H_2SO_4$$
  
 $(HSO_4)^{-} - H^{+} \rightarrow SO_4^{-2}$ 

85.  $Mg(OH)_2 \rightarrow [Mg^{2+}] + 2[OH^{-}]$ 

$$K_{sp} = [Mg] [OH]^2 = [x] [2x]^2 = x \cdot 4x^2 = 4x^3$$

- 86.  $K = (mol L^{-1})^{1-n} sec^{-1}, n = 0,1$
- 87.  $XeF_2$  sp<sup>3</sup> d 3 lone pairs

XeF<sub>4</sub> sp<sup>3</sup>d<sup>2</sup> 2 lone pairs

XeF<sub>6</sub> sp<sup>3</sup>d<sup>3</sup> 1 lone pa

- 89. Order is the sum of the point of the concentrations terms in rate law expression.
- 91. According to bond or values the given order is the answer. Bond order values are

+1, +1
$$\frac{1}{2}$$
, +2 and + 2 $\frac{1}{2}$ , higher bond order means stronger bond.

92.  $\Delta$  H +ve a low temperature and  $\Delta$  S +ve at low temperature shows that reaction is non spontane us

At high ten erature (boiling point) becomes feasible

- 93. Sime a chanical energy is always converted (lost) to other forms of energy.
- 95. A prding to their positions in the periods, these values are in the order:

57

$$Yb^{+3} < Pm^{+3} < Ce^{+3} < La^{+3}$$

At nos. 70 61 58

This is due to lanthanide contraction

96. KO<sub>2</sub> is a very good oxidising agent

$$_{7}N = 1s^{2} 2s^{2}3p^{3}$$
;  $_{15}P = 1s^{2}2s^{2}2p^{6}3s^{2}3p^{3}$ 

In phosphorous the 3d - orbitals are available,

100. PV = nRT (number of moles = n/V)  $\therefore n/V = P/RT$ 

- 103. NH<sub>4</sub><sup>+</sup> ions are increased to suppress release of OH<sup>-</sup> ions, hence solubility product of Fe(OH)<sub>3</sub> is attained. Colour of precipitate is different.
- 104. According to molecular weight given
- 107. 2<sup>nd</sup> excited state will be the 3rd energy level

$$E_n = \frac{13.6}{n^2} eV$$
 or  $E = \frac{13.6}{9} eV = 1.51 eV$ 

- 110.  $CH_3CH_2COOH \xrightarrow{Cl_2} CH_3CHCICOOH \xrightarrow{alc. KOH} CH_2 = CHCOOH \xrightarrow{According a color of the co$
- 111. Alumina is mixed with cryolite which acts as an electrolyte
- 112. Silver ore forms a soluble complex with NaCN from which silver is precipitated using scrapzinc.

114. 
$$\Delta T_b = K_b \times \frac{W_B}{M_B \times W_A} \times 1000 \; ; \Delta T_f = K_f \frac{W_B}{M_B \times W_A} \times 1000 \; ; \frac{\Delta T_b}{\Delta T_f} = \frac{K_b}{K_f} = \frac{\Delta T_b}{-0.136} = 0.0512^{\circ} \text{C}$$

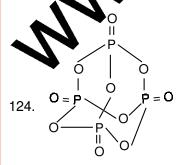
- 115.  $E_{cell}$  = Reduction potential of cathode (right) reduction potential of chode (left) =  $E_{right}$  -  $E_{left}$
- 116.  $\Delta x.\Delta v = \frac{h}{2\pi m}$
- 117. Acetylene reacts with the other three as

$$CH \equiv CNa \xleftarrow{Na}_{liq, NH_3} CH \equiv CH \xrightarrow{+HCl} CH_2 \xrightarrow{CH_2} CH_3$$

$$[AgNO_3 + NH_4OH] CH CH_2$$

$$AgC \equiv CAg + NH_4OH_3$$
white pot

- 118. In this reaction the ratio of number of moles of reactants to products is same i.e. 2 : 2, hence change in volume will be alter the number of moles.
- 119.  $\Delta$  H negative shows that the reaction is spontaneous. Higher value for Zn shows that the reaction is more feasible.
- 120. Mn<sup>2+</sup> has the maximum number of unpaired electrons (5) and therefore has maximum moment.
- 121. In motivules (a), (c) and (d), the carbon atom has a multiple bond, only (b) has sp<sup>3</sup> hybridisation



126. Beryllium shows anomalous properties due to its small size

127. 
$$E_{cell} = E_{right (cathode)} - E_{left (anode)}$$

128. 
$$CH \equiv CH + \xrightarrow{HOCI} \stackrel{CHOH}{\longrightarrow} \stackrel{HOCI}{\mid I \mid} \stackrel{HOCI}{\longrightarrow} \stackrel{CH(OH)_2}{\mid CHCI_2} \xrightarrow{-H_2O} \stackrel{CHO}{\longrightarrow} \stackrel{CHO}{\mid CHCI_2}$$

dichloroacetaldehyde

132. 
$$C_2H_5NH_2 + CHCI_3 + 3KOH \rightarrow C_2H_5N \equiv C + 3KCI + 3HCI$$

Ethyl isocyanide

135. After every 5 years amount is becoming half.

$$\therefore 64g \xrightarrow{\phantom{0}5yrs\phantom{0}} 32g \xrightarrow{\phantom{0}5yrs\phantom{0}} 16g \xrightarrow{\phantom{0}5yrs\phantom{0}} 8g$$

after 15 years.

143. 
$$_{0}$$
 $n^{1} \rightarrow_{+1} p^{1} + _{-1} e^{0}$ 

144. 
$$[\Delta H_{mix} < 0]$$
  
146. BCC - points are at corners and one in the patre of the unit cell

Number of atoms per unit cell =  $8 \times$ 

FCC - points are at the corners and entre of the six faces of each cell

Number of atoms per unit cell = 
$$\frac{1}{8}$$
  $\frac{1}{2}$  =  $\frac{1}{2}$ 

147. Fe (no. of moles) = 
$$\frac{558.5}{57.65}$$
 = 10 moles

C (no. of moles) = 60/

148. 
$$Mn_2 O_3 \leftarrow (-4e^-) [KN_1 O_4] - (-e^-) [MnO_4]^{-1}$$



$$Zh$$
 w  $\overset{\scriptscriptstyle{+1}}{A}gCN \longrightarrow 2A\overset{\scriptscriptstyle{0}}{g} + \overset{\scriptscriptstyle{+2}}{Z}n(CN)_{2}$ 

150. 
$$K_p = K_c (RT)^{\Delta n}; \Delta n = 1 - \left(1 + \frac{1}{2}\right) = 1 - \frac{3}{2} = -\frac{1}{2}$$

$$\therefore \frac{K_p}{K_c} = (RT)^{-1/2}$$

#### **AIEEE - 2002**

### **Mathematics Solution**

1. We have  $\alpha^2 = 5\alpha - 3$ 

$$\Rightarrow \alpha^2 - 5\alpha + 3 = 0 \Rightarrow \alpha = \frac{5 \pm \sqrt{13}}{2} \text{ . Similarly, } \beta^2 = 5\beta - 3 \Rightarrow \alpha = \frac{5 \pm \sqrt{13}}{2}$$

$$\therefore \alpha = \frac{5 + \sqrt{13}}{2}$$
 and  $\beta = \frac{5 - \sqrt{13}}{2}$  or vice - versa

$$\alpha^2 + \beta^2 = \frac{50 + 26}{4} = 19 \& \alpha\beta = \frac{1}{4}(25 - 13) = 3$$

Thus, the equation having  $\frac{\alpha}{\beta} \& \frac{\beta}{\alpha}$  as its roots is

$$x^{2} - x \left(\frac{\alpha}{\beta} + \frac{\beta}{\alpha}\right) + \frac{\alpha\beta}{\alpha\beta} = 0 \Rightarrow x^{2} - x \left(\frac{\alpha^{2} + \beta^{2}}{\alpha\beta}\right) + 1 = 0 \text{ or } 3x^{2} - 1 \Rightarrow x = 0$$

 $y = (x + \sqrt{1 + x^2})^n$ 

$$\frac{dy}{dx} = n(x + \sqrt{1 + x^2})^{n-1} \left(1 + \frac{1}{2}(1 + x^2)^{-1/2}.2x\right); \frac{dy}{dx} = n(x + \sqrt{1 + x^2})^{n-1} \frac{(\sqrt{1 + x^2} + x)}{\sqrt{1 + x^2}} = \frac{n(\sqrt{1 + x^2} + x)^n}{\sqrt{1 + x^2}}$$

or 
$$\sqrt{1+x^2} \frac{dy}{dx} = ny$$
 or  $\sqrt{1+x^2} y_1 = ny$   $\left( y_1 = \frac{1}{dx} \right)$ . Squaring,  $(1+x^2)y_1^2 = n^2y^2$ 

 $d^2$  .  $2yy_1$  (Here,  $y_2 = \frac{d^2y}{dx^2}$ ) or  $(1+x^2)y_2 + xy_1 = x^2y_1$ 

1, 
$$\log_9 (3^{1-x} + 2)$$
,  $\log_3 (4)$  are in A.P.  
 $\Rightarrow 2 \log_9 (3^{1-x} + 2) = 1 \log_3 (4.3^x - 1)$ 

$$\log_3 (3^{1-x} + 2) = \log_3 3 + \log_3 4.3^{x-1}$$

$$\log_3 (3^{1-x} + 2) = \log_3 3 + \log_3 4$$
  
 $\log_3 (3^{1-x} + 2) = \log_3 [3(4.3^x - 1)]$   
 $3^{1-x} + 2 = 3(4.3^{-1})$  (put  $3^x = 1$ )

$$3^{1-x} + 2 = 3(4.$$
 1) (put  $3^x = t$ )

Hence 
$$t = -\frac{1}{3}, \frac{3}{4} \Rightarrow 3^x = \frac{3}{4} \Rightarrow x = \log_3\left(\frac{3}{4}\right)$$
 or  $x = \log_3 3 - \log_3 4 \Rightarrow x = 1 - \log_3 4$ 

 $P(E_1) = \frac{1}{2}$ ,  $P(E_2) = \frac{1}{3}$  and  $P(E_3) = \frac{1}{4}$ ;  $P(E_1 \cup E_2 \cup E_3) = 1 - P(\overline{E}_1)P(\overline{E}_2)P(\overline{E}_3)$ 

$$= 1 - \left(1 - \frac{1}{2}\right) \left(1 - \frac{1}{3}\right) \left(1 - \frac{1}{4}\right) = 1 - \frac{1}{2} \times \frac{2}{3} \times \frac{3}{4} = \frac{3}{4}$$

5. 
$$\sin^2 \theta = \frac{1 - \cos 2\theta}{2}$$
; Period  $= \frac{2\pi}{2} = \pi$ 

6. 
$$\begin{split} I = AR^{p-1} & \Longrightarrow \log I = \log A + (p-1) \log R \\ m = AR^{q-1} & \Longrightarrow \log m = \log A + (q-1) \log R \\ n = AR^{r-1} & \Longrightarrow \log n = \log A + (r-1) \log R \\ \text{Now,} \end{split}$$

$$\begin{vmatrix} logI & p & 1 \\ logm & q & 1 \\ logn & r & 1 \end{vmatrix} = \begin{vmatrix} logA + (p-1)logR & p & 1 \\ logA + (q-1)logR & q & 1 \\ logA + (q-1)logR & r & 1 \end{vmatrix} = 0$$

$$7. \qquad \underset{x \rightarrow 0}{\text{Lim}} \, \frac{\sqrt{1 - \cos 2x}}{\sqrt{2}x} \Rightarrow \underset{x \rightarrow 0}{\text{Lim}} \frac{\sqrt{1 - (1 - 2\sin^2 x)}}{\sqrt{2}x} \, ; \\ \underset{x \rightarrow 0}{\text{Lim}} \frac{\sqrt{2\sin^2 x}}{\sqrt{2}x} \Rightarrow \underset{x \rightarrow 0}{\text{Lim}} \frac{|\sin x|}{x}$$

the function does not exist or LHS ≠ RHS

8. 
$$AB = \sqrt{(4+1)^2 + (0+1)^2} = \sqrt{26}$$
;  $BC = \sqrt{(3+1)^2 + (5+1)^2} = \sqrt{52}$ 

CA = 
$$\sqrt{(4-3)^2 + (0-5)^2} = \sqrt{26}$$
; So, in isosceles triangle AB = CA

For right angled triangle  $BC^2 = AB^2 + AC^2$ 

So, here BC = 
$$\sqrt{52}$$
 or BC<sup>2</sup> = 52 or  $(\sqrt{26})^2 + (\sqrt{26})^2 = 52$ 

So, given triangle is right angled and also isosceles

9. Total student = 100 ; for 70 stds 
$$75 \times 70 = 5250 \Rightarrow 720 - 550 = 1950$$

Average of girls = 
$$\frac{1950}{30}$$
 = 65

10. 
$$\cot^{-1}(\sqrt{\cos\alpha}) - \tan^{-1}(\sqrt{\cos\alpha}) = x$$

$$tan^{-1}\left(\frac{1}{\sqrt{\cos\alpha}}\right) - tan^{-1}(\sqrt{\cos\alpha}) + x \Rightarrow tan^{-1}\frac{\frac{1}{\sqrt{\cos\alpha}} - \sqrt{\cos\alpha}}{1 + \frac{1}{\sqrt{\cos\alpha}}.\sqrt{\cos\alpha}} = x$$

$$\Rightarrow \tan^{-1} \frac{1 - \cos \alpha}{2\sqrt{\cos \alpha}} = x \Rightarrow \tan^{-1} \frac{1 - \cos \alpha}{2\sqrt{\cos \alpha}} \text{ OR } \cot x = \frac{2\sqrt{\cos \alpha}}{1 - \cos \alpha} \text{ or } \csc x = \frac{1 + \cos \alpha}{1 - \cos \alpha}$$

$$\sin x = \frac{1 - \cos \alpha}{1 + \cos^2 \alpha} \frac{1 - (1 - 2\sin^2 \alpha/2)}{1 + 2\cos^2 \alpha/2 - 1} \text{ or } \sin x = \tan^2 \frac{\alpha}{2}$$

12. 
$$\frac{y-7}{5} = \frac{z-4}{4}$$
 .....(i

$$x(x-x) + b(y-7) + c(z-4) = 0$$
 ...... (ii)

$$a + 5x + 4c + 0$$
 ....... (iii

Solving the equation we get by equation (ii)

$$x - y + z = 1$$

13. 
$$\frac{d^2y}{dx^2} = e^{-2x}$$
;  $\frac{dy}{dx} = \frac{e^{-2x}}{-2} + c$ ;  $y = \frac{e^{-2x}}{4} + cx + d$ 

C(3.5)

14. 
$$\lim_{x \to \infty} \left( \frac{x^2 + 5x + 3}{x^2 + x + 3} \right)^{\frac{1}{x}} = \lim_{x \to \infty} \left( \frac{1 + \frac{5}{x} + \frac{3}{x^2}}{1 + \frac{1}{x} + \frac{3}{x^2}} \right)^{\frac{1}{x}} = 1$$

15. 
$$f(x) = \sin^{-1}\left(\log_3\left(\frac{x}{3}\right)\right)$$
 exists if

$$-1 \le \log_3\left(\frac{x}{3}\right) \le 1 \iff 3^{-1} \le \frac{x}{3} \le 3^1 \iff 1 \le x \le 9 \text{ or } x \in [1, 9]$$

17. 
$$ar^4 = 2$$
  
 $a \times ar \times ar^2 \times ar^3 \times ar^4 \times ar^5 \times ar^6 \times ar^7 \times ar^8$   
 $= a^9 r^{36} = (ar^4)^9 = 2^9 = 512$ 

18. 
$$\int_{0}^{10\pi} |\sin x| \, dx = 10 \left[ \int_{0}^{\pi/2} \sin x \, dx + \int_{\pi/2}^{\pi} \sin x \, dx \right]$$

$$=10\times[\cos x]_0^{\pi/2}+[\cos x]_{\pi/2}^{\pi}; \quad 10[1+1]=10\times 2=20$$

19. 
$$\int_{0}^{\pi/4} \tan^{n} x (1 + \tan^{2} x) dx = \int_{0}^{\pi/4} \tan^{n} x \sec^{2} x dx = \int_{0}^{1} t^{n} dt \text{ where } t = \tan x$$

$$I_{n} + I_{n+2} = \frac{1}{n+1}; \Rightarrow \lim_{x \to \infty} n[I_{n} + I_{n+2}] = \lim_{x \to \infty} n. \frac{1}{n} = \frac{n}{n+1} = \frac{n}{n(1+\frac{1}{n})} = 1$$

20. 
$$\int_{1}^{0} [x^{2}] dx + \int_{1}^{\sqrt{2}} [x^{2}] dx = 0 + \int_{1}^{\sqrt{2}} dx = 2$$

21. 
$$\int_{-\pi}^{\pi} \frac{2x(1+\sin x)}{1+\cos^2 x} dx = \int_{-\pi}^{\pi} \frac{2x}{1+\cos^2 x} + 2\int_{-\pi}^{\pi} \frac{x \sin x}{1+\cos^2 x}$$

$$= 0 + 4 \int_{0}^{\pi} \frac{x \sin x dx}{1 + c \cos^{2}(x - x)} I = 4 \int_{0}^{\pi} \frac{(\pi - x) \sin(\pi - x)}{1 + \cos^{2}(\pi - x)}$$

$$I = 4 \int_0^\pi \frac{(\pi \cdot x) \sin x}{1 + \cos^2 x} \Rightarrow I = 4\pi \int_0^\pi \frac{\sin x}{1 + \cos^2 x} - 4\pi \int \frac{x \sin x}{1 + \cos^2 x} \Rightarrow 2I = 4\pi \int_0^\pi \frac{\sin x}{1 + \cos^2 x} dx$$

plt cos = t and solve it.

22. We have, 
$$\lim_{x\to 2} \frac{xf(2)-2f(x)}{x-2} \left(\frac{0}{0}\right) = \lim_{x\to 2} f(2)-2f'(x) = f(2)-2f'(2) = 4-2\times 4 = -4$$

23. Let 
$$|z| = |\omega| = r$$
  $\therefore z = re^{i\theta}$ ,  $\omega = re^{i\phi}$  where  $\theta + \phi = \pi$   $\therefore \overline{\omega} = re^{-i\phi}$ 

$$\therefore z = re^{i(\pi-\phi)} = re^{i\pi} \cdot e^{-i\phi} = -re^{-i\phi} = -\overline{\omega}$$

24. Given 
$$|z-4| < |z-2|$$
 Let  $z = x + iy$   
 $\Rightarrow |(x-4) + iy)| < |(x-2) + iy| \Rightarrow (x-4)^2 + y^2 < (x-2)^2 + y^2$   
 $\Rightarrow x^2 - 8x + 16 < x^2 - 4x + 4 \Rightarrow 12 < 4x \Rightarrow x > 3 \Rightarrow Re(z) > 3$ 

26. Let a = first term of G.P.r = common ratio of G.P.; Then G.P. is a, ar, ar<sup>2</sup>

Given 
$$s_{\infty} = 20 \Rightarrow \frac{a}{1-r} = 20 \Rightarrow a = 20(1-r)$$
 ......(i)

Also 
$$a^2 + a^2r^2 + a^2r^4 + .....to \infty = 100 \Rightarrow \frac{a^2}{1 - r^2} = 100 \Rightarrow a^2 = 100(1 - r)(1 + r).....(ii)$$

From (i),  $a^2 = 400 (1-r)^2$ ; From (ii) and (iii), we get  $100 (1-r)(1+r) = 400 (1-r)^2$  $\Rightarrow$  1 + r = 4 - 4r  $\Rightarrow$  5r = 3  $\Rightarrow$  r = 3/5

27.  $1^3 - 2^3 + 3^3 - 4^3 + \dots + 9^3$  $= 1^3 + 3^3 + 5^3 + \dots + 9^3 - (2^3 + 4^3 + \dots + 8^3)$ For  $S_1$ ,  $t_n = (2n - 1)^3 = 8n^3 - 12n^2 + 6n - 1$  $S_1 = \Sigma t_n = 8\Sigma n^3 - 12\Sigma n^2 + 6\Sigma n - \Sigma 1$ 

$$= \frac{8n^2(n+1)^2}{4} - \frac{12n(n+1)(2n+1)}{6} + \frac{6n(n+1)}{2} - n$$

Here n = 5. Hence  $S_1 = 2 \times 25 \times 36 - 2 \times 5 \times 6 \times 11 + 3 \times 30$ = 1800 - 660 + 90 -5 = 1890 - 665 = 1225

For 
$$S_2$$
,  $t_n = 8n^3$ ;  $S_2 = \Sigma t_n = 8\Sigma n^3 = \frac{8n^2(n+1)^2}{4} = 2\times 16\times 25 = 100$ . (for  $n=4$ )

∴ Required sum = 1225 - 800 = 425.

Let  $\alpha, \beta$  and y,  $\delta$  are the roots of the equations. 28.

$$x^2 + ax + b = 0$$
 and  $x^2 + bx + a = 0$   $\therefore \alpha + \beta = a$ ,  $\beta = b$  and  $y + \delta = -b$ ,  $y\delta = a$ 

Given 
$$\alpha - \beta = y - \delta \Rightarrow (\alpha - \beta)^2 = (y - \delta)^2 \Rightarrow (y + \beta) \rightarrow 4\alpha\beta = (y + \delta)^2 - 4y\delta$$

$$\Rightarrow a^2 - 4b = b^2 - 4a \Rightarrow (a^2 - b^2) + 4(a - b) = 0 \Rightarrow a + b + 4 = 0 \quad (\because a \neq b)$$

p + q = -p and  $pq = q \Rightarrow q(p-1) = 0$   $\alpha = 0$  or p = 1If q = 0, then p = 0. i.e. p = q : p = 1 and q = -2

31. 
$$ab+bc+ca=\frac{(a+b+c)^2-1}{2}$$

- Required number of numbers =  $5 \times 6 \times 6 \times 4 = 36 \times 20 = 720$ 32.
- 33. Required number of numbers =  $3 \times 5 \times 5 \times 5 = 375$
- 34.
- Required numbers are 5! + 5! 4! = 216Required Scala (2+4+6+.....+100) + (5+10+15+.....+100) (10+20+.....+100) 35. 950 - 530 = 3050
- $_{p}$  =  $_{p+q}C_{p}$   $_{p}$   $_{q}$  and  $_{q+1}$  =  $_{p+q}C_{q}$   $_{q}$   $_{p+q}C_{p}$  =  $_{p+q}C_{q}$ . 36.
- ave  $2^n = 4096 = 2^{12} \implies n = 12$ ; So middle term =  $t_7$ ;  $t_7 = t_{6+1} = {}^{12}C_6 = \frac{12!}{6! \, 6!} = 924$
- 39.  $t_{+2} = {}^{2n}C_{r+1} \quad x^{r+1} ; \quad t_{3r} = {}^{2n}C_{3r-1} \quad x^{3r-1}$ Given  ${}^{2n}C_{r+1} = {}^{2n}C_{3r-1} \implies {}^{2n}C_{2n-(r+1)} = {}^{2n}C_{3r-1} \implies 2n - r - 1 = 3r - 1 \implies 2n = 4r$
- $\begin{vmatrix} a & b & ax + b \\ b & c & bx + c \\ ax + b & bx + c & 0 \end{vmatrix} By R_3 \rightarrow R_3 (xR_1 + R_2) = \begin{vmatrix} a & b & ax + b \\ b & c & bx + c \\ 0 & 0 & -(ax^2 + 2bx + x) \end{vmatrix}$ 40. We have  $= (ax^2 + 2bx + c) (b^2 - ac) = (+) (-) = -ve$

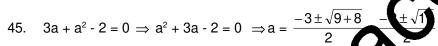
- 41.  $a_1 = \sqrt{7} < 7$ . Let  $a_m < 7$ . Then  $a_m + 1 = \sqrt{7 + a_m} \implies a_{m+1}^2 = 7 + a_m < 7 + 7 < 14$  $\Rightarrow$   $a_{m+1} < \sqrt{14} < 7$ ; So  $a_n < 7 \forall n : a_n > 3$
- Equation of AB is  $x\cos\alpha + y\sin\alpha = p \Rightarrow \frac{x\cos\alpha}{p} + \frac{y\sin\alpha}{p} = 1 \Rightarrow \frac{x}{p/\cos\alpha} + \frac{y}{p/\sin\alpha} = 1$

So co-ordinates of A and B are  $\left(\frac{p}{\cos\alpha},0\right)$  and  $\left(0,\frac{p}{\sin\alpha}\right)$ ; So coordinates of mid point of AB are

$$\left(\frac{p}{2\cos\alpha}, \frac{p}{2\sin\alpha}\right) = (x_1, y_1) \text{ (let) } ; \ x_1 = \frac{p}{2\cos\alpha} \& \ y_1 = \frac{p}{2\sin\alpha};$$

$$\Rightarrow \cos\alpha = p/2x_1 \text{ and } \sin\alpha = p/2y_1; \cos^2\alpha + \sin^2\alpha = 1 \Rightarrow \frac{p^2}{4} \left( \frac{1}{x_1^2} + \frac{1}{y_1^2} \right) = 1$$

Locus of 
$$(x_1, y_1)$$
 is  $\frac{1}{x^2} + \frac{1}{y^2} = \frac{4}{p^2}$ .



46. Equation of circles  $x^2 + y^2 = 1 = (1)^2$  $\Rightarrow$  x<sup>2</sup> + y<sup>2</sup> = (y - mx)<sup>2</sup>  $\Rightarrow$  x<sup>2</sup> = m<sup>2</sup>x<sup>2</sup> - 2 mxy

$$\tan 45 = \pm \frac{2\sqrt{m^2 - 0}}{1 - m^2} = \frac{\pm 2m}{1 - m^2} \Rightarrow 1 - m^2 + 2m \Rightarrow m^2 \pm 2m - 1 = 0$$

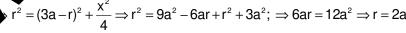
$$\Rightarrow m = \frac{-2 \pm \sqrt{4 + 4}}{2} = \frac{-2 \pm 2\sqrt{2}}{2} = -4$$

- Let (h, k) be the centre  $(x k)^2 + (y k)^2 = 3^2$ . Since (h, k) lies on  $(x k)^2 + (y k)^2 = 3^2$ . Since (h, k) lies on  $(x k)^2 + (y k)^2 = 3^2$ . 47.  $x^2 + y^2 - (2xh + 2vk) + 2yk$ ; Locus of (h, k) is  $x^2 + y^2 = 16$ , which clearly satisfies (a).
- Let ABC be an equilate al triangle, whose median is AD. 49.

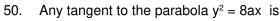
Given AD = 3:  
In 
$$\triangle$$
ABD, AB  $\triangle$ D<sup>2</sup> + BD<sup>2</sup>;

$$\Rightarrow x^2 = 9a + (x^2/4) \text{ where AB= BC= AC = x. } \frac{3}{4}x^2 = 9a^2 \Rightarrow x^2 = 12a^2$$

$$r^2 = (3a - r)^2 + \frac{x^2}{4} \Rightarrow r^2 = 9a^2 - 6ar + r^2 + 3a^2; \Rightarrow 6ar = 12a^2 \Rightarrow r = 2a^2$$

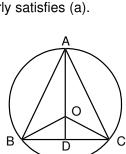






$$y = mx + \frac{2a}{m}$$
 ..... (i)

If (i) is a tangent to the circle, 
$$x^2 + y^2 = 2a^2$$
 then,  $\sqrt{2}a = \pm \frac{2a}{m\sqrt{m^2 + 1}}$ 



$$\Rightarrow$$
 m<sup>2</sup> (1 + m<sup>2</sup>) = 2  $\Rightarrow$  (m<sup>2</sup> + 2) (m<sup>2</sup> - 1) = 0;  $\Rightarrow$  m = ±1

So from (i),  $y = \pm (x + 2a)$ 

51. 
$$r_1 > r_2 > r_3 \Rightarrow \frac{\Delta}{s-a} > \frac{\Delta}{s-b} > \frac{\Delta}{s-c} \Rightarrow s-a < s-b < s-c \Rightarrow -a < -b < -c \Rightarrow a > b > c$$

52. The given equation is 
$$\tan x + \sec x = 2\cos x \implies \sin x + 1 = 2\cos^2 x$$

$$\Rightarrow$$
 sinx + 1 = 2(1-sin<sup>2</sup>x)  $\Rightarrow$  2sin<sup>2</sup>x + sinx - 1 = 0

$$\Rightarrow$$
 (2 sin x - 1) (sinx + 1) = 0  $\Rightarrow$  sinx =  $\frac{1}{2}$ , -1  $\Rightarrow$  x = 30°, 150°, 270°.

54. We have 
$$\lim_{n\to\infty} \frac{1^p + 2^p + \dots + n^p}{n^{p+1}}$$
;  $\lim_{n\to\infty} \sum_{r=1}^n \frac{r^p}{n^p \cdot n} = \int_0^1 x^p dx = \left[\frac{x^{p+1}}{p+1}\right]_0^1 = \frac{1}{p+1}$ 

55. Since 
$$\lim_{x\to 0} [x]$$
 does not exist, hence the required limit does not exist

56. 
$$\lim_{x\to 1} \frac{\sqrt{f(x)}-1}{\sqrt{x}-1}$$
  $\left(\frac{0}{0}\right)$  form

Using L' Hospital's rule 
$$\lim_{x \to \infty} \frac{\frac{1}{2\sqrt{f(x)}} f'(x)}{\frac{1}{2\sqrt{x}}} = \frac{f'(1)}{\sqrt{f(1)}} = \frac{2}{1} = 2$$

58. : 
$$f''(x) - g''(x) = 0$$

Integrating, 
$$f'(x) - g'(x) = c \Rightarrow f'(1) - g'(1) = c \Rightarrow 4 - c \Rightarrow c = 2$$

$$\therefore$$
 f'(x) - g'(x) = 2; Integrating, f(x) - g(x) = 2 + c<sub>1</sub>

$$\Rightarrow f(2) - g(2) = 4 + c_1 \Rightarrow 9 - 3 = 4 + c_1 \Rightarrow c_1 = 2 \qquad \therefore f(x) - g(x) = 2x + 2$$

At 
$$x = 3/2$$
,  $f(x) - g(x) = 3 + 2 = 5$ 

59. 
$$f(x + y) = f(x) \times f(y)$$

Differentiate with respect to x, reality as constant

$$f'(x+y) = f(x) f(y)$$

Putting x = 0 and y = ( y e get 
$$f'(x) = f'(0) f(x)$$
;  $\Rightarrow f'(5) = 3f(5) = 3 \times 2 = 6$ 

60 Distance of origin from 
$$(x, y) = \sqrt{x^2 + y^2}$$

$$= \sqrt{a^2 + b^2 - 2tb} \cdot \left(t - \frac{at}{b}\right) = \sqrt{a^2 + b^2 - 2ab} \quad \left[\because \max. \cos\left(t - \frac{at}{b}\right) = 1\right] = a - b$$

61. Let 
$$f(x) = \frac{a^3}{3} + \frac{bx^2}{2} + cx \Rightarrow f(0) = 0$$
 and  $f(1) = \frac{a}{3} + \frac{b}{2} + c = \frac{2a + 3b + 6c}{6} = 0$ 

Also f(x) is continuous and differentiable in [0,1] and [0, 1[. So by Rolle's theorem, f'(x) = 0. i.e.  $ax^2 + bx + c = 0$  has at least one root in [0, 1]

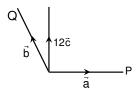
62. We have 
$$\int_{0}^{2} f(x) dx = \frac{3}{4}$$
; Now,  $\int_{0}^{2} x f'(x) dx = x \int_{0}^{2} f'(x) dx - \int_{0}^{2} f(x) dx$ 

= 
$$[xf(x)]_0^2 - \frac{3}{4} = 2f(2) - \frac{3}{4} = 0 - \frac{3}{4} (\because f(2) = 0) = -\frac{3}{4}$$

64. We have, 
$$\vec{a} \cdot \vec{b} = |\vec{a}| |\vec{b}| \cos \frac{\pi}{6} = 4 \times 2 \times \frac{\sqrt{3}}{2} = 4\sqrt{3}$$
.

Now, 
$$(\vec{a} \times \vec{b})^2 + (\vec{a} \cdot \vec{b})^2 = a^2b^2 \implies (\vec{a} \times \vec{b})^2 + 48 = 16 \times 4 \implies (\vec{a} \times \vec{b})^2 = 16$$

- 65. We have,  $[\vec{a} \times \vec{b} \ \vec{b} \times \vec{c} \ \vec{c} \times \vec{a}] = (\vec{a} \times \vec{b}) \cdot \{ \vec{b} \times \vec{c} \} \times (\vec{c} \times \vec{a})$ 
  - $= (\vec{a} \times \vec{b}) \cdot \left\{\! (\vec{m}.\vec{a}) \; \vec{c} (\vec{m}.\vec{c}) \vec{a} \right\} \quad \text{(where } \vec{m} = \vec{b} \times \vec{c} \text{)}$
  - $= \{(\vec{a} \times \vec{b}) \cdot \vec{c}\} \cdot \{\vec{a} \cdot (\vec{b} \times \vec{c})\} = [\vec{a}\vec{b}\vec{c}]^2 = 4^2 = 16$
- 66.  $\vec{a} + \vec{b} + \vec{c} = 0 \Rightarrow \vec{b} + \vec{c} = -\vec{a} \Rightarrow (\vec{b} + \vec{c})^2 = (\vec{a})^2 = 5^2 + 3^2 + 2\vec{b}\vec{c} = 7^2$
- $\Rightarrow 2|\vec{b}||\vec{c}|\cos\theta = 49 34 = 15 \Rightarrow 2 \times 5 \times 3\cos\theta = 15 \Rightarrow \cos\theta = 1/2 \Rightarrow \theta = \frac{\pi}{3} = 60^{\circ}$
- 67. We have,  $\vec{a} + \vec{b} + \vec{c} = \vec{0} \Rightarrow (\vec{a} + \vec{b} + \vec{c})^2 = 0$ 
  - $\Rightarrow |\,\vec{a}\,|^2 \,+|\,\vec{b}\,|^2 \,+|\,\vec{c}\,|^2 \,+2(\vec{a}.\vec{b}+\vec{b}.\vec{c}+\vec{c}.\vec{a}) = 0 \\ \Rightarrow 25 + 16 + 9 + 2(\vec{a}.\vec{b}+\vec{b}.\vec{c}+\vec{c}.\vec{a}) = 0$
  - $\Rightarrow$   $(\vec{a}.\vec{b}+\vec{b}.\vec{c}+\vec{c}.\vec{a}) = -25 \therefore |\vec{a}.\vec{b}+\vec{b}.\vec{c}+\vec{c}.\vec{a}| = 25$
- 69. We have  $\vec{a} \times \vec{b} = 39\vec{k} = \vec{c}$ 
  - Also  $|\vec{a}| = \sqrt{34}$ ,  $|\vec{b}| = \sqrt{45}$ ,  $|\vec{c}| = 39$  .:  $|\vec{a}| : |\vec{b}| : |\vec{c}| = \sqrt{34} : \sqrt{45} : 39$
- 71.  $P(A \cup B) = P(A) + P(B) P(A \cap B) \Rightarrow \frac{3}{4} = 1 P(\overline{A}) + P(B) \frac{1}{4}$ 
  - $\Rightarrow 1 = 1 \frac{2}{3} + P(B) \Rightarrow P(B) = \frac{2}{3}; \quad \text{Now,} P(\overline{A} \cap B) = P(B) P(A \cap B) = \frac{5}{4} = \frac{5}{12}$
- 72. The event follows binomial distribution with n = 5, p = 3/2 = 1/2 q = 1 p = 1/2  $\therefore$  Variance npq = 5/4
- 73. Equation of plane through (1, 0, 0) is
  - $a(x 1) + by + cz = 0 \dots (i)$
  - (i) passes through (0, 1, 0)
  - a + b = 0  $\Rightarrow$  b = a; Also,  $\cos 45^{\circ}$
  - $\Rightarrow$  2a =  $\sqrt{2a^2 + c^2} \Rightarrow 2a^2 = c$
  - So. d.r. of normal are a (a ) Levie 1,1,  $\sqrt{2}$
- 74. Let two forces be P = A + Q + Q = A + Q = A + Q = A + Q = A + Q = A + Q = A + Q = A + Q = A + Q
  - $\Rightarrow$  P<sup>2</sup> +144 Q = (-8-P)<sup>2</sup>;  $\Rightarrow$  P<sup>2</sup> +144 = 324 36P + P<sup>2</sup>
  - $\Rightarrow$  36 1.0  $\Rightarrow$  P = 5 and Q = 13
  - ( he and  $\vec{b}$  are unit vectors along P and Q).



# **KEY FOR AIEEE - 2002 PAPER**

THEMISTRY 41. a 82. b 123. d 13. b 54. a 1.  1. a 42. b 83. a 124. d 14. d 55. d 56. a 3.  1. a 42. b 83. a 126. d 15. a 56. a 57. b 4.  2. b 43. a 84. a 125. d 16. b 57. b 4.  3. b 44. c 85. a 126. d 16. b 57. b 4.  4. b 45. a 86. a 127. a 17. b 58. d 59. c 6.  5. c 46. d 87. d 128. c 18. d 59. c 6.  6. c 47. b 88. a 129. b 19. b 60. a 7.  7. a 48. b 89. a 130. c 20. c 61.  8. a 49. b 90. b 131. d 21. b 62. d 99. b 19. b 62. d 99. b 11.  10. c 51. b 92. b 133. a 23. b 64. b 11.  11. c 52. c 93. a 134. b 24. c 66. a 13. b 66. a 13. b 54. a 66. a 14. a 55. a 96. a 136. d 25. c 66. a 67. a 14. a 55. a 96. a 136. d 25. c 66. a 68. b 16. c 57. b 98. c 139. a 28. a 68. b 18. b 69. b 100. c 17. a 68. b 100. c 17. a 148. b 34. d 75. a 68. b 100. c 144. b 34. d 75. a 68. b 100. c 144. b 34. d 75. a 68. b 100. c 144. b 34. d 75. a 68. b 100. c 144. b 34. d 75. a 68. b 100. c 144. b 34. d 75. a 68. b 100. c 149. d 39. c 144. a 145. a 148. b 148. c 148. b 148. b 148. b 148. c 148. c 148. b 148. b 148. c 14	PHVS	ICS &	40.	С	81.	b	122.	d	12.	а	53.	b
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5.         c         46.         d         87.         d         128.         c         18.         d         59.         c           6.         c         47.         b         88.         a         129.         b         19.         b         60.         a           7.         a         48.         b         89.         a         130.         c         20.         c         61.           8.         a         49.         b         90.         b         131.         d         21.         b         62.         d           9.         b         50.         d         91.         b         132.         a         22.         c         63.         -           10.         c         51.         b         92.         b         133.         a         23.         b         64.         b           11.         c         52.         c         93.         a         134.         b         24.         a         65.         a           12.         b         53.         b         94.         c         135.         d         25.         d         66.         a <td>I</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>-</td> <td></td> <td></td> <td></td>	I								-			
6.	l								-			
7.       a       48.       b       89.       a       130.       c       20.       c       61.         8.       a       49.       b       90.       b       131.       d       21.       b       62.       d         9.       b       50.       d       91.       b       132.       a       22.       c       63.         10.       c       51.       b       92.       b       133.       a       23.       b       64.       b         11.       c       52.       c       93.       a       134.       b       24.       a       65.       a         12.       b       53.       b       94.       c       135.       d       25.       c       66.       a         13.       b       54.       d       95.       a       136.       d       67.       a       66.       a         14.       a       55.       a       96.       a       137.       a       29.       c       70.       c         15.       a       56.       d       97.       c       138.       o       29. <td< td=""><td>I</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>_</td><td></td><td></td><td>-C</td></td<>	I								_			-C
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10.       c       51.       b       92.       b       133.       a       23.       b       64.       b         11.       c       52.       c       93.       a       134.       b       24.       c       66.       a         12.       b       53.       b       94.       c       135.       d       25.       66.       a         13.       b       54.       d       95.       a       136.       d       25.       66.       a         14.       a       55.       a       96.       a       137.       a       27.       a       68.       b         15.       a       56.       d       97.       c       138.       q       28.       a       69.       b         16.       c       57.       b       98.       c       139.       a       29.       c       70.       c         17.       c       58.       c       99.       a       140.       d       30.       a       71.       a         18.       b       59.       b       100.       c       141.       o       31.							-		-			<u>a</u>
11.       c       52.       c       93.       a       134.       b       24.       a       65.       a         12.       b       53.       b       94.       c       135.       d       25.       66.       a         13.       b       54.       d       95.       a       136.       d       25.       66.       a         14.       a       55.       a       96.       a       137.       a       27.       a       68.       b         15.       a       56.       d       97.       c       138.       c       28.       a       69.       b         16.       c       57.       b       98.       c       139.       a       23.       c       70.       c         17.       c       58.       c       99.       a       140.       d       30.       a       71.       a         18.       b       59.       b       100.       c       141.       d       31.       a       72.       d         19.       b       60.       a       101.       a       143.       c       33.									-			
12. b 53. b 94. c 135. d 25.							_			D		<u> </u>
13.       b       54.       d       95.       a       136.       d       66.       67.       a         14.       a       55.       a       96.       a       137.       a       27.       a       68.       b         15.       a       56.       d       97.       c       138.       c       28.       a       69.       b         16.       c       57.       b       98.       c       139.       a       29.       c       70.       c         17.       c       58.       c       99.       a       140.       d       30.       a       71.       a         18.       b       59.       b       100.       c       141.       d       31.       a       72.       d         19.       b       60.       a       101.       a       148.       c       33.       c       74.       a         20.       b       61.       b       102.       a       143.       c       33.       c       74.       a         21.       c       62.       d       103.       144.       b       34.							_			Â.	•	
14.       a       55.       a       96.       a       137.       a       27.       a       68.       b         15.       a       56.       d       97.       c       138.       c       28.       a       69.       b         16.       c       57.       b       98.       c       139.       a       29.       c       70.       c         17.       c       58.       c       99.       a       140.       d       30.       a       71.       a         18.       b       59.       b       100.       c       141.       d       31.       a       72.       d         19.       b       60.       a       101.       a       143.       c       33.       c       74.       a         20.       b       61.       b       102.       a       144.       b       34.       d       75.       a         21.       c       62.       d       103.       a       144.       b       34.       d       75.       a         22.       b       63.       c       106.       b       147.	I —								25.			
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16.       c       57.       b       98.       c       139.       a       29.       c       70.       c         17.       c       58.       c       99.       a       140.       d       30.       a       71.       a         18.       b       59.       b       100.       c       141.       d       31.       a       72.       d         19.       b       60.       a       101.       a       18.       b       32.       d       73.       b         20.       b       61.       b       102.       a       143.       c       33.       c       74.       a         21.       c       62.       d       103.       a       144.       b       34.       d       75.       a         22.       b       63.       c       103.       d       144.       b       34.       d       75.       a         23.       b       64.       d       103.       d       144.       b       36.       a         24.       c       65.       a       106.       b       147.       a       38.	l							a				
17.       c       58.       c       99.       a       140.       d       30.       a       71.       a         18.       b       59.       b       100.       c       141.       d       31.       a       72.       d         19.       b       60.       a       101.       a       18.       b       32.       d       73.       b         20.       b       61.       b       102.       c       143.       c       33.       c       74.       a         21.       c       62.       d       103.       144.       b       34.       d       75.       a         21.       c       62.       d       103.       144.       b       34.       d       75.       a         22.       b       63.       c       10.       145.       b       35.       b         23.       b       64.       d       106.       b       147.       a       37.       c         25.       a       66.       b       07.       a       148.       c       38.       c         26.       c       67.		а				С	_				69.	b
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21.	19.	b	60.	а	101.	a 🔷	1.0	b	32.	d	73.	b
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27.       a       b       109.       c       150.       c       40.       c         28.       c       110.       c       MATHEMATICS 41.       b       c         29.       70.       d       111.       c       1.       a       42.       a         30.       71.       a       112.       b       2.       a       43.       d         41.       b       72.       a       113.       c       3.       c       44.       a         43.       a       73.       c       114.       b       4.       a       45.       a         33.       c       74.       a       115.       c       5.       b       46.       c         34.       b       75.       c       116.       c       6.       d       47.       a         35.       a       76.       c       117.       a       7.       a       48.       b         36.       d       77.       c       118.       a       8.       a       49.       c         37.       c       78.       b       119.       d       9.	25.	а	66.	b	707.	а	148.	С	38.	С		
28.	26.	С	67.	a♠	108.	С	149.	d	39.	С		
29. 70. d 111. c 1. a 42. a 30 71. a 112. b 2. a 43. d 44. a 45. a 45. a 45. a 46. c 46. c 47. a 47. a 48. b 47. a 48. b 47. a 48. b 47. a 48. b 48. a 49. c	27.	a	13:	b	109.	С	150.	С	40.	С		
30       71.       a       112.       b       2.       a       43.       d         1       b       72.       a       113.       c       3.       c       44.       a         38.       a       73.       c       114.       b       4.       a       45.       a         33.       c       74.       a       115.       c       5.       b       46.       c         34       b       75.       c       116.       c       6.       d       47.       a         35.       a       76.       c       117.       a       7.       a       48.       b         36.       d       77.       c       118.       a       8.       a       49.       c         37.       c       78.       b       119.       d       9.       b       50.       b         38.       b       79.       a       120.       a       10.       a       51.       a	28.	С	M	c	110.	С	MATH	EMATI	CS 41.	b		
31.       b       72.       a       113.       c       3.       c       44.       a         32.       a       73.       c       114.       b       4.       a       45.       a         33.       c       74.       a       115.       c       5.       b       46.       c         34.       b       75.       c       116.       c       6.       d       47.       a         35.       a       76.       c       117.       a       7.       a       48.       b         36.       d       77.       c       118.       a       8.       a       49.       c         37.       c       78.       b       119.       d       9.       b       50.       b         38.       b       79.       a       120.       a       10.       a       51.       a	29.	N	70.	d	111.	С	1.	а	42.	а		
31.       b       72.       a       113.       c       3.       c       44.       a         32.       a       73.       c       114.       b       4.       a       45.       a         33.       c       74.       a       115.       c       5.       b       46.       c         34.       b       75.       c       116.       c       6.       d       47.       a         35.       a       76.       c       117.       a       7.       a       48.       b         36.       d       77.       c       118.       a       8.       a       49.       c         37.       c       78.       b       119.       d       9.       b       50.       b         38.       b       79.       a       120.       a       10.       a       51.       a	30		71.	а	112.	b	2.	а	43.	d		
33. c 74. a 115. c 5. b 46. c 34 b 75. c 116. c 6. d 47. a 35. a 76. c 117. a 7. a 48. b 36. d 77. c 118. a 8. a 49. c 37. c 78. b 119. d 9. b 50. b 38. b 79. a 120. a 10. a 51. a		b	72.	а	113.	С	3.	С	44.	а		
34     b     75.     c     116.     c     6.     d     47.     a       35.     a     76.     c     117.     a     7.     a     48.     b       36.     d     77.     c     118.     a     8.     a     49.     c       37.     c     78.     b     119.     d     9.     b     50.     b       38.     b     79.     a     120.     a     10.     a     51.     a	6 2.	а	73.	С	114.	b	4.	а	45.	а		
35. a 76. c 117. a 7. a 48. b 36. d 77. c 118. a 8. a 49. c 37. c 78. b 119. d 9. b 50. b 38. b 79. a 120. a 10. a 51. a	35.	С	74.	а	115.	С	5.	b	46.	С		
36.     d     77.     c     118.     a     8.     a     49.     c       37.     c     78.     b     119.     d     9.     b     50.     b       38.     b     79.     a     120.     a     10.     a     51.     a	34	b	75.	С	116.	С	6.	d	47.	а		
37.     c     78.     b     119.     d     9.     b     50.     b       38.     b     79.     a     120.     a     10.     a     51.     a	35.	а	76.	С	117.	а	7.	а	48.	b		
37.     c     78.     b     119.     d     9.     b     50.     b       38.     b     79.     a     120.     a     10.     a     51.     a	36.	d	77.	С	118.	а	8.	а	49.	С		
38. b 79. a 120. a 10. a 51. a	37.	С		b		d	9.	b	50.	b		
	38.	b	79.	а	120.	а	10.	а	51.	а		
	I — —					b						