Monthly Progressive Test (Solution)

Class: XII

Subject: PCMB

Academic Excellence Programme TECHNO ACE

Test Booklet No.: MPT08 | Test Date: 20122024

Physics

1. Ⓑ

$E \propto \frac{1}{r^3} \Rightarrow F \propto \frac{1}{r^3}$

Therefore, $\frac{F'}{F} = \frac{r^3}{(2r)^3}$

$F' = \frac{F}{8}$

2. Ⓒ

Case I : $F = q\left(\frac{\sigma}{\varepsilon_0}\right)$

Case II : $F' = q\left(\frac{\sigma}{2t_0}\right) = \frac{F}{2}$

3. Ⓑ

$R \propto$ temperature

$\text{temperature} \propto \frac{1}{\text{relaxation time}}$

4. Ⓓ

$\frac{1}{r} = \frac{1}{0.1} \times 5 = 50$

$r = \frac{1}{50} = 0.02$

$R' = r + R = 0.02 + 9.98 = 10 \text{ ohm}$

$i = \frac{2}{10} = 0.2 \text{ A}$

5. Ⓑ

$w = qv = k = \frac{1}{2}mv^2 \qquad \therefore v \propto \sqrt{V}$

$r = \frac{mv}{qB} \quad \therefore r \propto \sqrt{V}$

$\frac{r'}{r} = \frac{\sqrt{2V}}{\sqrt{V}} \qquad \Rightarrow r' = \sqrt{2}r$

6. ©

$F = B\,i\,l = mg$

$i = \left(\frac{mg}{Bl}\right)$

7. ©

$\vec{\tau} = \vec{M} \times \vec{B} = \left(50\hat{i}\right) \times \left(0.5\hat{i} + 3.0\,\hat{j}\right) = 150\hat{k}$ N-m

8. ©

$Q = \vec{B} \cdot \vec{A}$

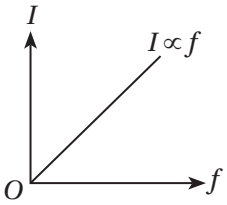
$= \left(\hat{i} + 0.5\,\hat{j}\right) \cdot \pi\left(\frac{1}{10}\right)^2 \left(0.6\hat{i} + 0.8\,\hat{j}\right)$

$= \frac{\pi}{100}(0.6 + 0.4)(mT)(m^2) = \frac{3.14}{100}\, m\, wb = 31.4\,\mu\, wb$

9. ©

$I \cdot X_c = V$

$I\left(\frac{1}{2\pi f}\right) = V$



10. Ⓑ

Ultraviolet rays.

11. Ⓑ

As rays will meet at focus, so reflected wave is a spherical wave of radius f i.e., $R/2$.

12. Ⓑ

$p = x + x = 2x \qquad \therefore\ x = p/2$

13. Ⓑ

Case I : $\Delta x = \lambda$

$\phi = \left(\frac{2\pi}{\lambda}\right)(\lambda) = 2\pi$

$I_0 = I_1 + I_1 + 2I\cos 2\pi = 4I_1$

$\therefore I_1 = \frac{I_0}{4}$

Case II : $\Delta x = \frac{\lambda}{4}$

$\phi = \left(\frac{2\pi}{\lambda}\right)\left(\frac{\lambda}{4}\right) = \frac{\pi}{2}$

$\cos\left(\frac{\pi}{2}\right) = 0$

$I = I_1 + I_1 = 2I_1 = \frac{I_0}{2}$

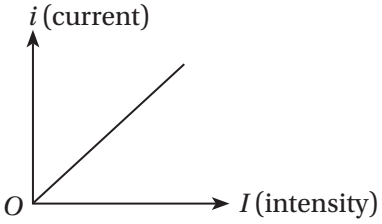
14. Ⓒ

$3.315\,(\text{eV}) = \frac{1242}{\lambda\,(\text{nm})}\,(\text{eV-nm})$

$\lambda = \frac{1242}{3.315} = 375\,(\text{nm})$

15. Ⓐ

We know



$i \propto I$

Again, $i = \frac{ne}{t} \quad \therefore i \propto \left(\frac{n}{t}\right)$

16. Ⓒ

$k = \frac{1}{2}mv^2 = \frac{1}{4\pi\epsilon_0}\cdot\frac{(Ze)(2e)}{d}$

$d \propto \left(\frac{1}{k}\right)$ for particular Z

17. Ⓓ

$\frac{1}{\lambda} = R\left(1 - \frac{1}{25}\right) = \frac{24R}{25}$

$\frac{1}{\lambda'} = R\left(\frac{1}{4} - \frac{1}{25}\right) = \frac{21}{100}R$

$\frac{1}{\lambda'} = \frac{21}{100} \times \frac{25}{24} \times \frac{1}{\lambda} = \frac{7}{32} \times \frac{1}{\lambda}$

$\lambda' = \left(\frac{32}{7}\right)\lambda$

18. Ⓑ

Nuclear densities are equal.

19. Ⓒ

$17 \times 7.75 - 16 \times 7.97 = 131.75 - 127.52 = 4.23$ M eV

20. Ⓐ

The p-n is in forward bias but current is zero as 0.5 volt < 0.7 volt.

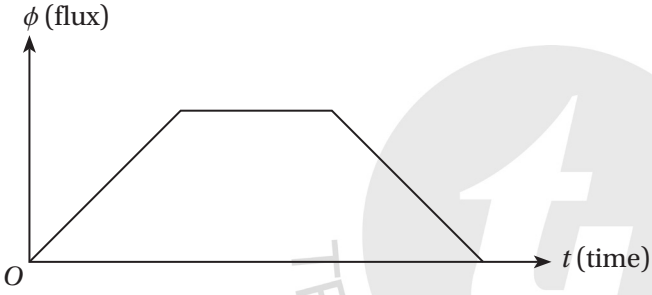
21. Ⓑ

As copper is diamagnetic.

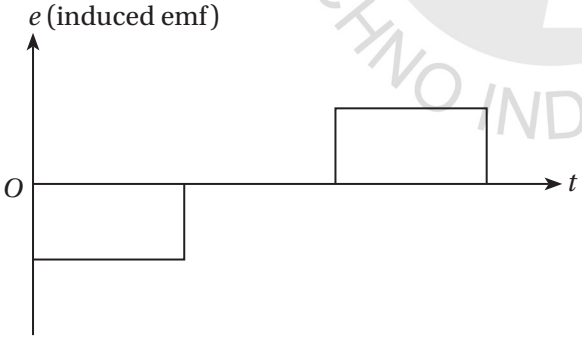
22. Ⓑ

$\phi = L\, i = (2.5)(5) = 12.5$ wb

23. Ⓓ



24. Ⓑ



25. Ⓒ

$$\text{During entry} = \frac{2 \text{ cm}}{1 \text{ (cm/s)}} = 2 \text{ s}$$

$$\text{During exit} = \frac{2 \text{ cm}}{1 \text{ (cm/s)}} = 2 \text{ s}$$

Total time = 2 + 2 = 4 s

Chemistry

26. Ⓐ

Both CO_3^{2-} and NO_3^- have 32 electrons and hence are isoelectronic. C & N are sp^2 hybridised. So, both

CO_3^{2-} and NO_3^- ions are plannar and hence isostructural. $H = \frac{1}{2}(V + M - C + A)$

$H_{CO_3^{2-}} = \frac{1}{2}(4 + 0 - 0 + 2) = 3 \Rightarrow sp^2$

$H_{NO_3^-} = \frac{1}{2}(5 + 0 - 0 + 1) = 3 \Rightarrow sp^2$

27. Ⓐ

Number of P = 0 double bonds = 3 and Number of P – 0 and = 9.

28. Ⓑ

deep blue solution of $[Cu(NH_3)_4]^{2+}$

$$CuSO_4 + H_2S \xrightarrow{\text{Dil.HCl}} \underset{\text{(Black ppt)}}{CuS\downarrow} + H_2SO_4$$

$$CuS + 2HNO_3 \longrightarrow \underset{\text{(Blue Solution)}}{Cu(NO_3)_2} + H_2S$$

$$Cu(NO_3)_2 + 4NH_3 \longrightarrow [Cu(NH_3)_4]^{2+} + 2NO_3^{\ominus}$$

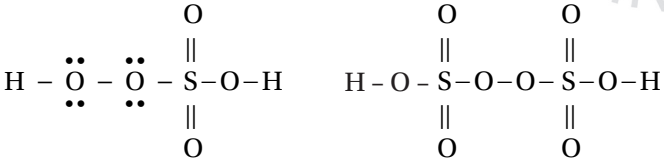
29. Ⓑ

NO_2, PbO_2

$$\underset{\text{(Lead nitrate)}}{2Pb(NO_3)_2} \xrightarrow{\Delta} \underset{\text{(Yellow)}}{2PbO} + \underset{\text{(Brown gas)}}{4NO_2\uparrow} + O_2\uparrow$$

30. Ⓐ

H_2SO_5 & $H_2S_2O_8$ have peroxide O – O bond.



31. Ⓓ

In solid state PCl_5 exists in ionic form – $[PCl_4]^+$ is tetrahedral whereas $[PCl_6]^O$ is octahedral form.

32. Ⓑ

$3d^5$ has maximum number of unpaired electron.

33. Ⓓ

$MnSO_4$ formed in the reaction acts as autocatalyst.

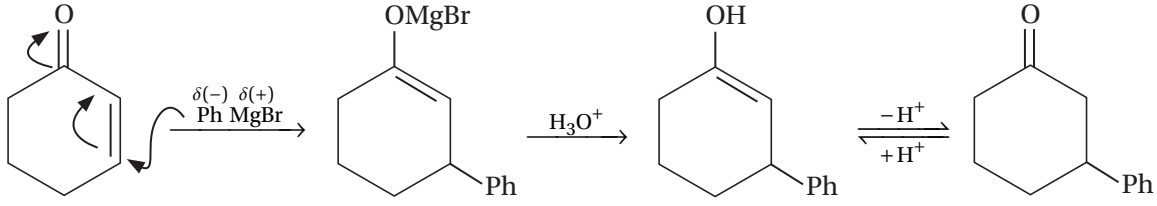
34. Ⓒ

Actinoid series is from atomic number 90 to 103. Thulium (T_m) has atomic number 69 and is a lanthanoid.

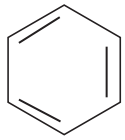
35. Ⓒ

$$\Delta_t = \frac{4}{9} \cdot \Delta_0 = \frac{4}{9} \times 18000\ cm^{-1}$$
$$= 8000\ cm^{-1}$$

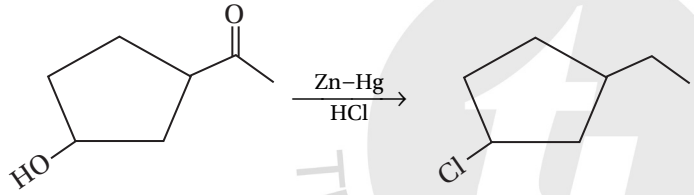
36. Ⓐ



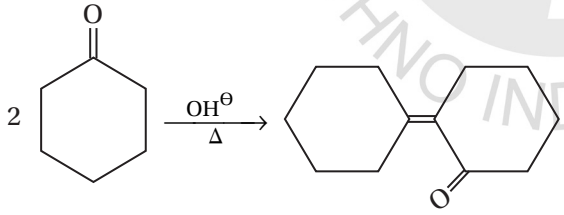
37. Ⓓ


; Ring expansion and aromatisation.

38. Ⓐ



39. Ⓒ



40. Ⓓ

During mutarotation of β–D–glucose in aqueous solution angle of optical rotation changes from an angle of +19.2° to a constant value of +52.5°.

41. Ⓐ

$$E = E^\circ - \frac{0.059}{2}\log_{10}[H^+]^2$$
$$= 1.30 + 0.059 \times 3 \quad [pH = 3, (H^+) = 10^{-3}]$$
$$= 1.48\ V.$$

42. Ⓐ

Both assertion and reason are correct and reason is the correct explanation of assertion.

43. Ⓒ

Assertion is correct but reason is wrong. Thus, the answer is C.

44. Ⓑ

Both assertion and reason are correct, but reason is not the correct explanation of assertion. Arrhenius equation,

$K = A \cdot e^{-\frac{E_a}{RT}}$

For, $E_a = 0$, $K = A$, both assertion and reason are correct but, reason is not the correct explanation of assertion.

45. Ⓐ

Given, $P_A^\circ = 70$ torr, $P_T = 84$ torr

$X_B = 0.2$; $\therefore\ X_A = 1 - X_B = 1 - 0.2 = 0.8$

$P_B^\circ = ?$

$\therefore\ P_T = P_A^\circ \cdot x_A + P_B^\circ \cdot x_B$

$\Rightarrow 84 = 70 \times 0.8 + P_B^\circ \times 0.2$

$\Rightarrow P_B^\circ = 140$ mm.Hg.

46. Ⓒ

$Na_4[Fe(CN)_6]$; 60% ionised

$i = 1 + (n - 1)\,\alpha = 1 + (5 - 1)\,\alpha = 1 + 4\alpha$

$C = 2 \times 10^{-3}$ M ; $T = (27 + 273) = 300$K

$\pi = i.CRT$

$= (3.4)(2 \times 10^{-3})(0.0821)(300)$

$= 0.167$ atm

47. Ⓓ

$\lambda^\alpha_{CH_3COON_a} = \lambda^\alpha_{CH_3COO^-} + \lambda^\alpha_{Na^+}$

$\lambda^\alpha_{HCl} = \lambda^\alpha_{H^+} + \lambda^\alpha_{Cl^-}$

$\lambda^\alpha_{NaCl} = \lambda^\alpha_{Na^+} + \lambda^\alpha_{Cl^-}$

$\lambda^\alpha_{CH_3COOH} = \lambda^\alpha_{CH_3CCONa} + \lambda^\alpha_{HCl} - \lambda^\alpha_{NaCl} = 91 + 426 - 126$

$= 391$

$\therefore\ \alpha = \frac{\wedge_c}{\wedge^\alpha} = \frac{19.55}{391} = 0.05;\ [H^+] = \alpha \times C = 0.05 = 5 \times 10^{-2}$

$\therefore\ pH = -\log(H^+) = -\log_{10}[5 \times 10^{-2}]$

$= 2 - \log 5 = 2 - 0.7 = 1.3$

48. Ⓒ

$A(g) \longrightarrow B(g) + C(g)$

At, $t = 0$ $\quad P_0 \quad 0 \quad 0$

t = t $P_0 - P$ P P ; $P_t = P_0 - P + P + P$

$= P_0 + P$

$\therefore\ P = (P_t - P_0)$

From 1st order kinetics,

$$K = \frac{2.303}{t}\log_{10}\frac{P_0}{P_0 - P} = \frac{2.303}{t}\log_{10}\frac{P_0}{P_0 - (P_t - P_0)}$$

$$= \frac{2.303}{t}\log_{10}\left(\frac{P_0}{2P_0 - P_t}\right)$$

49. Ⓑ

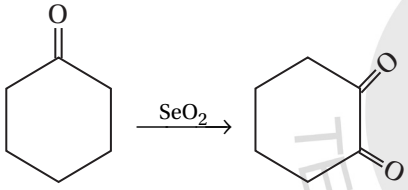
Reaction :

1st order kinetics as unit of 'K' is S^{-1}.

$\therefore$ Rate, $r = K[N_2O_5]$

$$\Rightarrow [N_2O_5] = \frac{r}{K} = \frac{1.02\times10^{-4}}{3.4\times10^{-5}} = 3M$$

50. Ⓐ



Mathematics

51. Ⓒ

$$\begin{bmatrix} x+y \\ x-y \end{bmatrix} = \begin{bmatrix} 0 \\ -2 \end{bmatrix} \Rightarrow x+y=0 \text{ and } x-y=-2 \Rightarrow x=-1;\ y=1$$

52. Ⓓ

$$\begin{vmatrix} -2 & 4 & 1 \\ 2 & k & 1 \\ 5 & 1 & 1 \end{vmatrix} = \pm 70 \Rightarrow -2(k-4)-4(2-5)+1(8-5k) = \pm 70$$

$$\Rightarrow -7k+28 = \pm 70 \Rightarrow -7k+28 = 70 \text{ or } -7k+28 = -70 \Rightarrow k = -6;\ k = 14$$

$\therefore\ k = -6, 14$

53. Ⓐ

$$\text{Point of contact} = \left(\frac{a}{m^2}, \frac{2a}{m}\right) = \left(\frac{1}{1^2}, \frac{2\times1}{1}\right) = (1,2)$$

54. Ⓐ

$$\sin^{-1}\left(-\frac{1}{2}\right) = \theta \in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right] \Rightarrow \theta = -\frac{\pi}{6}$$

55. ©

$|Adj\ A| = |A|^{n-1} = 5^{3-1} = 5^2 = 25$

56. Ⓑ

degree = 2 as $\frac{d^2y}{dx^2}$ has the power 2.

57. Ⓓ

$\frac{dy}{dx} - \frac{y}{x} = x$

IF $= e^{-\int \frac{dx}{x}} = e^{-\log_e x} = e^{\log_e x^{-1}} = x^{-1} = \frac{1}{x}$

58. Ⓑ

$|\hat{i} - \hat{j}|^2 = (\hat{i} - \hat{j}) \cdot (\hat{i} - \hat{j})$

$= |i|^2 - \hat{j} \cdot \hat{i} - \hat{i} \cdot \hat{j} + |\hat{j}|^2$

$= 1 + 1 \quad (\because \hat{i} \cdot \hat{j} = 0 \text{ as } \hat{i} \perp \hat{j})$

$= 2$

59. Ⓓ

$\begin{vmatrix} 1 & -1 & 2 \\ -1 & 2 & 0 \\ 2 & -2 & 2 \end{vmatrix} = -6 \neq 0$

Since $\Delta \neq 0$, the lines are not coplanar and hence do not intersect.

60. Ⓐ

$\int \frac{\sin x + \cos x}{\sqrt{1 + \sin 2x}} dx = \int \frac{\sin x + \cos x}{(\sin x + \cos x)} dx = \int dx = x + c$

61. Ⓓ

$y = \tan^{-1}(e^x), \frac{dy}{dx} = \frac{1}{1 + (e^x)^2} \times e^x \qquad \left.\frac{dy}{dx}\right|_{x=0} = \frac{e^0}{1 + (e^0)^2} = \frac{1}{2}$

62. Ⓐ

$\frac{x-3}{2} = \frac{y+2}{-5} = \frac{z-6}{3}$

$\vec{r} = (3\hat{i} - 2\hat{j} + 6\hat{k}) + \lambda(2\hat{i} - 5\hat{j} + 3\hat{k})$

63. ©

$\int_{-\pi}^{\pi} \sin^{2023} x\, dx + \int_{-\pi}^{\pi} x^{1023}\, dx = 0$ (As both are odd function)

64. Ⓓ

$\int_{e}^{e^4} \sqrt{\log_e x}\, dx \qquad$ put $\log_e x = t^2 \quad \Rightarrow x = e^{t^2} \quad \Rightarrow dx = e^{t^2} 2t\, dt$

$$\int_1^2 \underset{\text{I}}{t}\cdot\underset{\text{II}}{e^{t^2}\,2t\,dt} = \left[t\cdot e^{t^2}\right]_1^2 - \int_1^2 e^{t^2}\,dt = 2e^4 - e - a \qquad \text{(by part)}$$

65. Ⓐ

Tangent changes from vertical to horizontal that is θ changes from 90° to 180°

$\therefore$ $\tan\theta$ increases in this range

$f'(x)$ increases $\Rightarrow f''(x) > 0$

66. Ⓑ

$(x,y)\in R \rightarrow x^2+y^2=1$

$(y,x)\in R \rightarrow y^2+x^2=1$

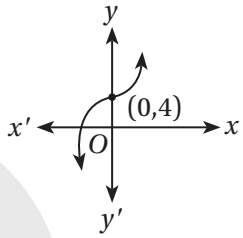
} Symmetric

67. Ⓒ

$f'(x) = 3x^2 \geq 0 \Rightarrow$ increasing $\Rightarrow$ one-one

Codomain = R = Range $\Rightarrow$ onto

$\Rightarrow$ Bijective



68. Ⓐ

At $x = \pi$, $|x - \pi|$ is non differentiable but at this point $\sin x$ is zero.

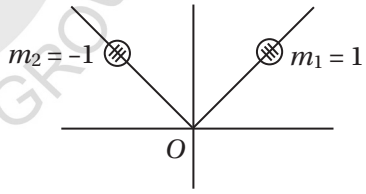
Therefore $f(x)$ becomes differentiable at $x = \pi$ and hence on R.

69. Ⓑ

Continuity $\nRightarrow$ differentiality

Example : $y = f(x) = |x|$

Continuous at $x = 0$ but not differentiable.



70. Ⓓ

$$f'(x) = \frac{(\lambda\cos x - 6\sin x) - (2\cos x - 3\sin x)}{(2\sin x + 3\cos x)^2} = \frac{(\lambda-2)\cos x - 3\sin x}{(2\sin x + 3\cos x)^2}$$

$f'(x) > 0$ if $(\lambda-2)\cos x - 3\sin x > 0$

$$\Rightarrow \sqrt{(\lambda-2)^2+9}\left(\frac{\lambda-2}{\sqrt{(\lambda-2)^2+9}}\cos - \frac{3}{\sqrt{(\lambda-2)^2+9}}\sin x\right) > 0$$

$$\Rightarrow \sqrt{(\lambda-2)^2+9}\,(\cos\alpha\cdot\cos x - \sin\alpha\sin x) > 0$$

$$\Rightarrow \sqrt{(\lambda-2)^2+9}\,(\cos(x+\alpha)) > 0$$

If $x+\alpha \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ and $|\lambda-2| \geq 3 \Rightarrow \lambda-2 \geq 3$ or $\lambda-2 \leq -3 \Rightarrow x \geq 5$ or $\lambda \leq -1$

$\therefore \lambda > 4$

71. Ⓑ

For unique solutions $a_1b_2 - a_2b_1 \neq 0$

There are total 2^4 cases in which 6 cases are there where there is unique solutions.

Required Probability $= \frac{6}{16} = \frac{3}{8}$ True

R $\rightarrow$ True

72. Ⓑ

Required prob $= \underbrace{\frac{13C_2}{52C_2} \times \frac{11}{50}}_{\text{2 spades missing}} + 3 \times \underbrace{\frac{13C_2}{52C_2} \times \frac{13}{50}}_{\text{other than spade missing but from same suit}} + 3 \times \underbrace{\frac{13C_1 \times 13C_1}{52C_2} \times \frac{12}{50}}_{\text{(exactly one spade missing)}} + 3 \times \frac{13C_1 \times 13C_1}{52C_2} \times \frac{13}{50} + 3 \times \underbrace{\frac{13C_1 \times 13C_1}{52C_2} \times \frac{13}{50}}_{\text{other than spade both cards from different suit}} = \frac{1}{4}$

73. Ⓐ

Objective function is Max $z = 11x + 9y$

74. Ⓐ

$x + y \leq 20$

75. Ⓐ

Feasible region always lies in First quadrant.

Biology

76. Ⓐ

Two synergids and an egg

77. Ⓒ

Linkage

Linked genes occur on the same chromosome and are transmitted together

78. Ⓑ

AUG

79. Ⓓ

Flippers of penguins and dolphins

Flippers of penguins and dolphins have originated from different ancestors

80. Ⓒ

Metastasis

81. Ⓒ

Propionibacterium shermanii

82. Ⓑ

Commensalism

Barnacles attach themselves to the skin of whales and feed on particles in the water brought by the movement of

their hosts. The whale is not benefited due to this attachment

83. Ⓑ

Marine

The amount of biomass is least at the base of the pyramid (phytoplankton) and maximum at the apex

84. Ⓓ

A is false but R is true

85. Ⓐ

Both A and R are true and R is the correct explanation of A

86. Ⓐ

Both A and R are true and R is the correct explanation of A

87. Ⓐ

Both A and R are true and R is the correct explanation of A

88. Ⓑ

Both A and R are true but R is not the correct explanation of A

89. Ⓑ

Bryophytes appeared earlier than pteridophytes and gymnosperms

90. Ⓐ

Lobefins

91. Ⓒ

Homo sapiens neanderthalensis

92. Ⓐ

Natural selection

It is an adaptation where the peppered moth living in the industrial areas developed melanin pigment to hide from their predators.

93. Ⓐ

Haemophilia

94. Ⓒ

$(2n + 1)$

95. Ⓒ

Turner's syndrome

96. Ⓒ

Sex linked recessive disorder

It occurs when an individual has genes for colour blindness in all X chromosomes

97. Ⓐ

f; secondary oocyte

98. Ⓐ

Oestrogen and LH

99. Ⓐ

At foetal stage

100. Ⓓ

Placenta

It stimulates the thickening of the uterine lining for implantation.