VITEEE 2019 Question Paper

Vellore Institute of Technology Engineering Entrance Examination

SOLVED PAPER
(memory based)

VITEEE

GENERAL INSTRUCTIONS

- This question paper contains total 125 questions divided into four parts :
  Part I : Physics Q. No - 1 to 40
  Part II : Chemistry Q. No - 41 to 80
  Part III : Mathematics Q. No - 81 to 120
  Part IV : English Q. No - 121 to 125
- All questions are multiple choice questions with four options, only one of them is correct.
- For each correct response, the candidate will get 1 mark.
- There is no negative marking for the wrong answer.
- The test is of 2½ hours duration.

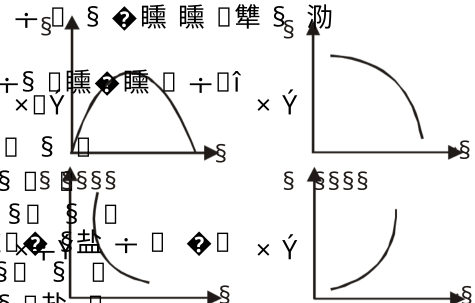
PART - I (PHYSICS)

1. [illegible]

2. [illegible]

3. [illegible]

4. [illegible]



5. [illegible]

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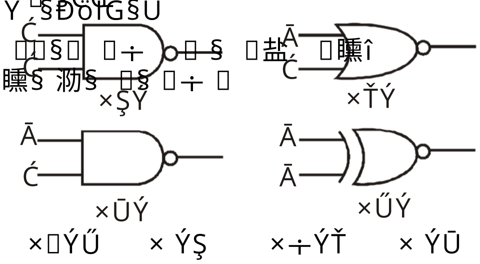
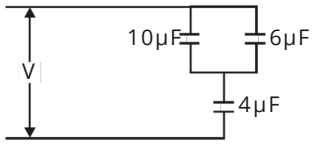


7. A point charge q is rotated along a circle in the electric field generated by another point charge Q. The work done by the electric field on the rotating charge in one complete revolution is
(a) zero
(b) positive
(c) negative
(d) zero if the charge Q is at the centre and nonzero otherwise.

8. The equivalent capacitance of the combination of the capacitors is



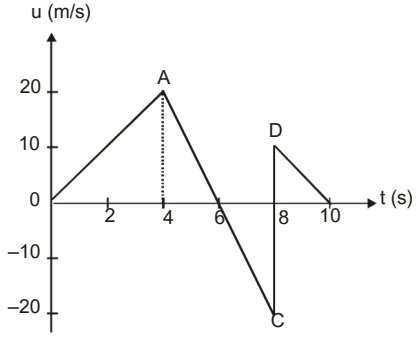
(a) 3.20μF
(b) 7.80μF
(c) 3.90μF
(d) 2.16μF

9. The half-life period and the mean life period of a radioactive element are denoted respectively by Th and Tm. Then
(a) $T_h = T_m$ (b) $T_h > T_m$
(c) $T_h < T_m$ (d) $T_h^3 T_m$

10. In a common base mode of a transistor, the collector current is 5.488 mA for an emitter current of 5.60 mA. The value of the base current amplification factor (b) will be
(a) 49 (b) 50 (c) 51 (d) 48

11. The magnetic field at a distance r from a long wire carrying current i is 0.4 tesla. The magnetic field at a distance 2r is
(a) 0.2 tesla (b) 0.8 tesla
(c) 0.1 tesla (d) 1.6 tesla

12. The velocity-time graph of a body moving in a straight line is shown in fig. Find the displacement and distance travelled by the body in 10 seconds.



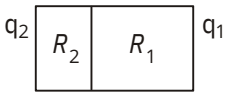
(a) 50m, 90m (b) 5m, 9m
(c) 9m, 5m (d) 90m, 50m

13. An electric dipole is kept in a uniform electric field. It experiences
(a) a force and a torque
(b) a force, but no torque
(c) a torque but no net force
(d) neither a force nor a torque

14. A person swims in a river aiming to reach exactly on the opposite point on the bank of a river. His speed of swimming is 0.5 m/s at an angle of 120° with the direction of flow of water. The speed of water is
(a) 1.0 m/s (b) 0.5 m/s
(c) 0.25 m/s (d) 0.43 m/s

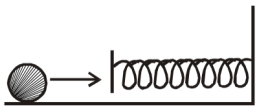
15. A rain drop of radius 0.3 mm has a terminal velocity in air is 1 m/s. The viscosity of air is 8 × 10–5 poise. The viscous force on it is
(a) 45.2 × 10–4 dyne (b) 1.73 × 10–5 dyne
(c) 16.95 × 10–4 dyne (d) 16.95 × 10–5 dyne

16. Consider a pair of insulating blocks with thermal resistances R_1 and R_2 as shown in the figure. The temperature q at the boundary between the two blocks is



(a) $(q_1 q_2 (R_1 + R_2)) / (q_1 + q_2)(R_1 + R_2)$
(b) $(q_1 R_1 + q_2 R_2) / (R_1 + R_2)$
(c) $[(q_1 + q_2) R_1 R_2] / (R_1 + R_2)^2$
(d) $(q_1 R_2 + q_2 R_1) / (R_1 + R_2)$

17. A mass of 0.5 kg moving with a speed of 1.5 m/s on a horizontal smooth surface, collides with a nearly weightless spring of force constant k = 50 N/m. The maximum compression of the spring would be



(a) 0.5 m (b) 0.15 m
(c) 0.12 m (d) 1.5 m

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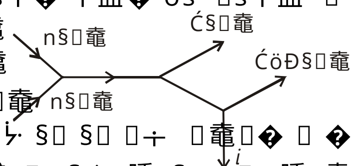

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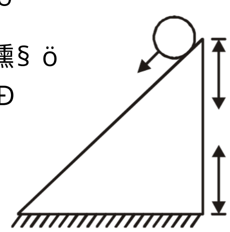

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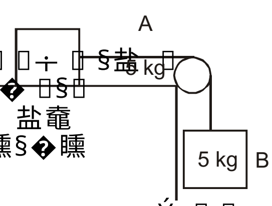

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(A) $\sqrt{ns}$ (B) $\frac{\sqrt{ns}}{p}$

(C) $\frac{p}{\sqrt{n}}$ (D) np

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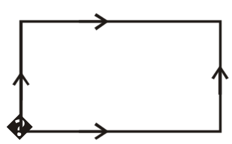

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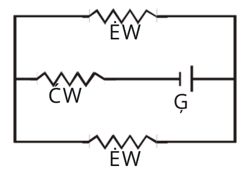

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PART - II (CHEMISTRY)

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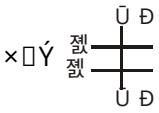
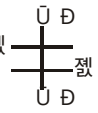
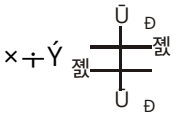


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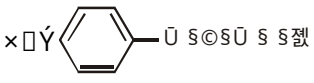
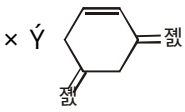

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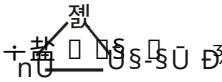

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53. In a closed insulated container, a liquid is stirred with a paddle to increase its temperature. In this process, which of the following is true ?

(a) $\Delta E < W < Q < 0$

(b) $\Delta E > 0, Q < W < 0$

(c) $\Delta E < W > 0, Q < 0$

(d) $\Delta E < Q > 0, W < 0$

54. At low pressure, the van der Waal's equation is reduced to

(a) $Z = \frac{PV_m}{RT} = 1 - \frac{a}{VRT}$

(b) $Z = \frac{PV_m}{RT} = 1 + \frac{b}{RT}P$

(c) $PV_m = RT$

(d) $Z = \frac{PV_m}{RT} = 1 - \frac{a}{RT}$

55. Copper sulphate solution reacts with KCN to give

(a) $Cu(CN)_2$ (b) $CuCN$

(c) $K_2[Cu(CN)_4]$ (d) $K_3[Cu(CN)_4]$

56. For the reaction

$H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(l), \Delta H = -285.8\ kJ\ mol^{-1}$

$\Delta S = -0.163 kJ\ mol^{-1} K^{-1}$.

What is the value of free energy change at 27°C for the reaction ?

(a) –236.9 kJ mol–1 (b) –281.4 kJ mol–1

(c) –334.7 kJ mol–1 (d) +334.7 kJ mol–1

57. $A \xrightarrow[dil.\ H_2SO_4]{} B \xrightarrow[H_2O]{} CH_3-\underset{OH}{\overset{CH_3}{\underset{|}{\overset{|}{C}}}}-CH_3$,

the reactant A is

(a) $CH_3CHOHCH_3$ (b) CH_3COCH_3

(c) C_2H_5OH (d) CH_3COOH

58. Bragg's law is given by the which of the following equation?

(a) $n\lambda = 2d\sin\theta$ (b) $n\lambda = 2d\sin\theta$

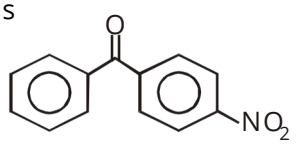
(c) $2n\lambda = d\sin\theta$ (d) $n\frac{\lambda}{2} = \frac{d}{2}\sin\theta$

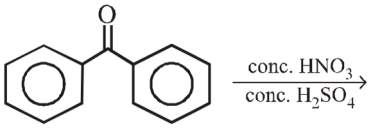
59. The reaction $2NO(g) + O_2(g) \rightarrow 2NO_2(g)$ is of first order. If volume of reaction vessel is reduced to 1/3, the rate of reaction would be

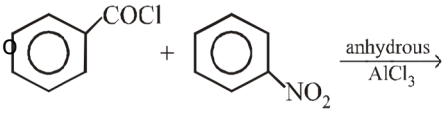
(a) 1/3 times (b) 2/3 times

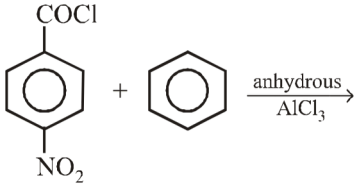
(c) 3 times (d) 6 times

60. Which are the starting materials for the preparation of?



(a) 

(b) 

(c) 

(d) Any of the three

61. Which element gives maximum number of oxides?

(a) V (b) Cr (c) Mn (d) Fe

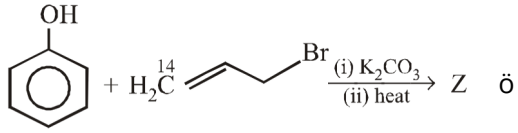
62. An organic compound 'A' has the molecular formula C_3H_6O, it undergoes iodoform test. When saturated with dil. HCl it gives 'B' of molecular formula C_9H_{12}. A and B respectively are

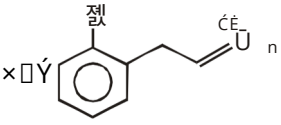
(a) Propanal and mesitylene

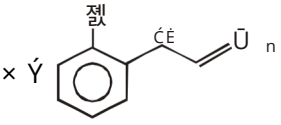
(b) Propanone and mesityl oxide

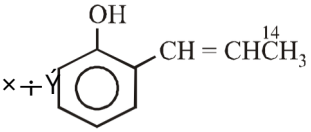
(c) Propanone and 2,6-dimethyl-2, 5-heptadien-4-one

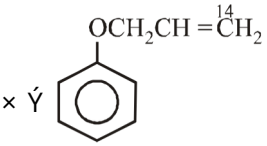
(d) Propanone and mesitylene oxide

63. 









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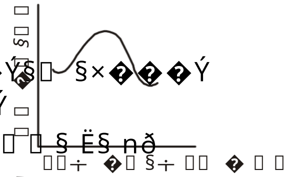

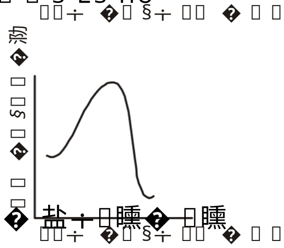

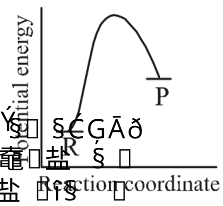

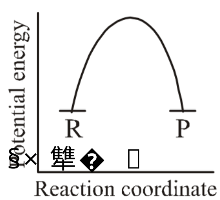

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PART - III (MATHEMATICS)

81. If $q = \sqrt{\quad}$ the value of q is

(1) $\frac{\quad}{\quad}$ (2) $\frac{\quad}{\quad}$ (3) $\frac{\quad}{\quad}$ (4) $\frac{\quad}{\quad}$

82. If n is

(1) n (2) n (3) n (4) n

83. If $\frac{\quad}{\quad}$ then $\frac{\quad}{\quad}$ is equal to

(1) $\frac{\quad}{\quad}$ (2) $\frac{\quad}{\quad}$ (3) $\frac{\quad}{\quad}$ (4) $\frac{\quad}{\quad}$

84. The value of $\frac{\quad}{\quad}$ is

(1) $\frac{\quad}{\quad}$ (2) $\frac{\quad}{\quad}$ (3) $\frac{\quad}{\quad}$ (4) $\frac{\quad}{\quad}$

85. If $w = \frac{-\sqrt{\quad}}{\quad}$ then $\frac{\quad}{\quad}$ is

(1) $\frac{\quad}{\quad}$ (2) $\frac{\quad}{\quad}$ (3) $\frac{\quad}{\quad}$ (4) $\frac{\quad}{\quad}$

86. If $\frac{\quad}{\quad}$ then $\frac{\quad}{\quad}$ is equal to

(1) $\frac{\quad}{\quad}$ (2) $\frac{\quad}{\quad}$ (3) $\frac{\quad}{\quad}$ (4) $\frac{\quad}{\quad}$

87. $\frac{\quad}{\quad}$ is equal to

(1) $\frac{\quad}{\quad}$ (2) $\frac{\quad}{\quad}$ (3) $\frac{\quad}{\quad}$ (4) $\frac{\quad}{\quad}$

88. If $y = \frac{\quad}{\quad}$ then $\frac{dy}{dx} =$

(1) $\frac{\quad}{\quad}$ (2) $\frac{\quad}{\quad}$ (3) $\frac{\quad}{\quad}$ (4) $\frac{\quad}{\quad}$

89. If $\frac{\quad}{\quad}$ then $\frac{\quad}{\quad}$ is equal to

(1) $\frac{\quad}{\quad}$ (2) $\frac{\quad}{\quad}$ (3) $\frac{\quad}{\quad}$ (4) $\frac{\quad}{\quad}$

90. If $\frac{\quad}{\quad}$ then $\frac{\quad}{\quad}$ is equal to

(1) $\frac{\quad}{\quad}$ (2) $\frac{\quad}{\quad}$ (3) $\frac{\quad}{\quad}$ (4) $\frac{\quad}{\quad}$

91. If $\frac{\quad}{\quad}$ then $\frac{\quad}{\quad}$ is equal to

(1) $\frac{\quad}{\quad}$ (2) $\frac{\quad}{\quad}$ (3) $\frac{\quad}{\quad}$ (4) $\frac{\quad}{\quad}$

92. If $\frac{\quad}{\quad}$ then $\frac{\quad}{\quad}$ is equal to

(1) $\frac{\quad}{\quad}$ (2) $\frac{\quad}{\quad}$ (3) $\frac{\quad}{\quad}$ (4) $\frac{\quad}{\quad}$

93. If $\frac{\quad}{\quad}$ then $\frac{\quad}{\quad}$ is equal to

(1) $\frac{\quad}{\quad}$ (2) $\frac{\quad}{\quad}$ (3) $\frac{\quad}{\quad}$ (4) $\frac{\quad}{\quad}$

94. [illegible]

95. [illegible]

96. [illegible]

97. [illegible] $= n(nx + y)$ [illegible]

98. [illegible]

99. [illegible]

100. [illegible] y [illegible] x [illegible]

$\frac{p}{n}$ [illegible]

101. [illegible]

102. [illegible]

103. [illegible] x [illegible] y [illegible] z [illegible]

104. [illegible]

105. 计算 $\int \frac{dx}{x^2\sqrt{x^2-a^2}}$

106. 已知 $f(x)=\ln(x+\sqrt{1+x^2})$，$g(x)$ 是 $f(x)$ 的反函数，则 $g'(x)=$

107. 设 $f(x)=\int_{\sin x}^{\cos x}\frac{dt}{\sqrt{1-t^2}}$，则 $f'(x)=$

108. 设 $y=\sqrt{\frac{x(x-1)}{x+1}}$，则 $y'=$

109. 和 $\int \frac{dx}{\sin x\cos x}$ 相等的是

110. 设 $y=\begin{cases}\ln(1+x), & x\ge 0\\ x^2, & x<0\end{cases}$，则 $y'=$

111. 计算 $\int \frac{dx}{\sqrt{ax+b}+\sqrt{cx+d}}$

112. 计算 $\int \frac{dx}{x\sqrt{1+x^n}}$

113. 设 $y=y(x)$ 由 $\begin{cases}x=\int_0^t \ln(1+u^2)\,du\\ y=t^2\ln(1+t^2)-t^2+\arctan t\end{cases}$ 确定，则 $\frac{d^2y}{dx^2}=$

114. 设 A 为 n 阶矩阵，B 为 n 阶可逆矩阵，A^* 为 A 的伴随矩阵，则 $(BA)^*=$

115. 设 A 为 n 阶矩阵，$|A|=a\neq 0$，A^* 为 A 的伴随矩阵，则 $|A^*|=$

117. The value of x in the interval [4, 9] at which the function $f(x) = \sqrt{x}$ satisfies the mean value theorem is

(a) $\frac{13}{4}$ (b) $\frac{17}{4}$ (c) $\frac{21}{4}$ (d) $\frac{25}{4}$

118. The value of the integral $\int_{-1}^{3}(|x+1|+|x-1|)dx$ is

(a) 4 (b) 9 (c) 2 (d) $\frac{9}{2}$

119. Let a, b, c, be in A.P. with a common difference d. Then $e^{1/c}, e^{b/ac}, e^{1/a}$ are in :

(a) G.P. with common ratio ed
(b) G.P with common ratio e1/d
(c) G.P. with common ratio $e^{2/(b-2d)}$
(d) A.P.

120. If the second term in the expansion $\left(\sqrt{a}+\frac{a}{\sqrt{a}-1}\right)^{n}$ is $14a^{5/2}$, then ${}^{n}C_{3}$ =

(a) (b) 3 (c) 12 (d) 6

PART - IV (ENGLISH)

121. In the given sentence, find out which part has an error. The letter of that part will be your answer. If there is no error, mark (d) as your an swer. She is a brilliant teacher (a)/ but of her three children (b)/ neither has any merit. (c)/ No error (d)

122. Find the synonym of the word IMPECCABLE
(a) Remarkable (b) Unbelievable
(c) Flawless (d) Displeasing

123. Find the antonym of the word AMELIORATE
(a) Improve (b) Depend
(c) Soften (d) Worsen

124. Find the meaning of the given idiom
A bolt from the blue
(a) An unpleasant event
(b) An inexplicable event
(c) A delayed event
(d) An unexpected event

125. Read the passage and answer the given question There seems to be no chilly distance existing between the German students and the professor, but, on the contrary, a companionable intercourse, the opposite of chilliness and reserve. When the professor enters a beer hall in the evening where students are gathered together, these rise up and take off their caps and invite the old gentleman to sit with them and partake. He accepts, and the pleasant talk and the beer flow for an hour or two, and by and by the professor, properly charged and comfortable, gives a cordial good night, while the students stand bowing and uncovered, and then he moves on his happy way homeward with all his vast cargo of learning afloat in his hold. Nobody finds fault or feels outraged. No harm has been done. What does the author mean by the phrase 'no chilly distance'?
(a) Professor's home is not very far from the beer hall.
(b) Students and the professor are very friendly with each other.
(c) The weather is not very chilly in Germany.
(d) being very strict scares the students quite a few times as in the beer h al l.

SOLUTIONS

PART - I (PHYSICS)

1. (c) $Ć = \frac{r\,IĆ}{ŞĆ}$ îš □ 雙nš§©§□l §n§©§n Ć

ŞĆ§©§ Ć

Şn @§ ×ⁿnÝ §§©Ý§©§ⁿ§©§Ė Ş

$_n = \frac{r\,In}{Ş_n}$

\ $Rn = \frac{r \times nĆÝ}{ĖA_Ć} = \frac{r}{n}\frac{IĆ}{A_Ć} = \frac{R_Ć}{n}$

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2 (d .) $_n = - _Ć = \frac{ĆĀĀ}{ĮĀ} - \frac{ĆĀĀ}{nĀ} = -$ ÐöÎĜ Ű

□ðŤ □瞟 瞟□§雙□ □ □ 瞟 î

3 (d .) $I = \_ = \frac{}{\sqrt{nö\ 竈ö \times \tilde{\#}ö}}$ ŶÝ

$§§\mu \frac{Ć}{\sqrt{\tilde{\#}öŶ}}$

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雙□ □ □ 瞟 § $\frac{I}{\div □竈 □瞟§}$

4. (c) □ö§ □ § 盐÷ 瞟 □§ □ § 瞟§ □竈□§ § 瞟§ □瞟 □ § 渺

= □□-I

□ □ □îš □ = §瞟 瞟 瞟□ § 盐÷ 瞟 □

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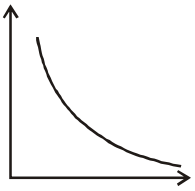
渺Ŧ □□ ├

和□§÷□ □÷ § 瞟 □ § 瞟§ § □ 瞟÷□竈瞟 瞟§×÷Ý 瞟□§= $\frac{ĆĢĆĖ}{ĆĢ+Ė} = \frac{ĢĖ}{nĀ}$ = Ðönm



5. (c) ỳ·瞟 §□ ÷瞟 □ §瞟 □ □§÷□ □瞟 □ 瞟§ □§ §©§n

n §□ ÷瞟 □ §瞟 □ □§÷□ □瞟 □ 瞟§ □§ § ©§Ð

Ş瞟§ Ŷ $\frac{Ć}{\mu_n}$

□÷瞟Ć瞟 $\frac{n}{ⁿ_n} = \frac{Ðn}{n} = \frac{Ê}{Ê}$

×ŞÝ $\hat{Ý}^n_Ć$

6. (d) 瞟§□§ Ş Ű§瞟□ □§瞟□§□盐 盐 §瞟瞟

$\bar{C} = Ć = Ć = Ā$

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$\overline{Ā + Ć} = Ć = Ā$

×ŪÝ 瞟§□§ Ş Ű§瞟□ □§瞟□§□盐 盐 §瞟瞟

$\bar{Ā} = Ć = Ā = Ć$

×ŰÝ 瞟§□§ 졠 §瞟□ □§瞟□§□盐 盐 §瞟瞟

Ā Å Ā = Ā

7. (a) □□ ├§ □ □§ 瞟 § 瞟瞟 □÷□竈□ § □ § ÷ □ 瞟□î

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□§ 瞟瞟 □÷□竈□ §□ §÷ □ 瞟□

□ ÷□îš雙□ ├§ □ □§瞟 §÷□竈 □ □§ □ □ 瞟□ §瞟瞟

□ □□ 渺

8. (a) Ŷ乙盐瞟 □ □ § ÷□ □÷瞟 □ ÷□§ □ § 雙□§ □ □ □

÷□ □÷瞟 □ 瞟§ĆĀ§m §□ §Ģ§m §©§×ĆĀ§è§Ģ Ým §©§ĆĢ§m

瞟§ĆĢ§m §÷□ □÷瞟 □ §瞟瞟§ 瞟§瞟□ 瞟□瞟§÷□竈 瞟 □ ÷

雙瞟§ §Ė m §÷□ □÷瞟 □ î

\§ Ŷ乙盐瞟 □ □ § ÷□ □÷瞟 □ ÷□§ □ § □§ □ 瞟 □

□竈瞟 瞟 √ 瞟 $\frac{ĆĢĆĖ}{ĆĢ+Ė} = \frac{ĢĖ}{nĀ}$ = Ðönm

9. (c) Half life, $T_h = \frac{0.693}{\lambda}$, $T_m = \frac{1}{\lambda}$

Clearly, Th<Tm.

10. (a) Ic = 5.488 mA, Ie = 5.6 mA

$$a = \frac{I_c}{I_e}$$

$$a = \frac{5.488}{5.6}$$

a

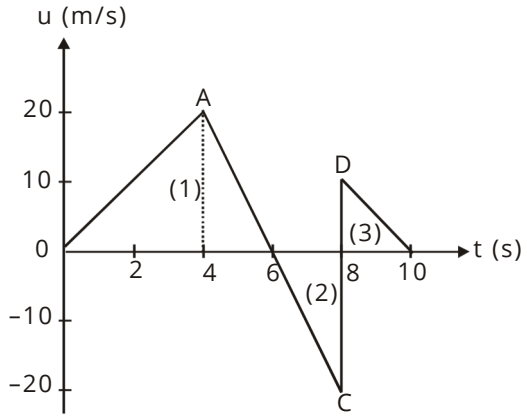
$$b = \frac{}{(1-a)} = 49$$

11. (a) Magnetic field due to long wire,

$$B = \frac{\mu_0 i}{2\pi r} \text{ or } B \propto \frac{1}{r}$$

When *r* is doubled, the magnetic field becomes half, i.e., now the magnetic field will be 0.2 T.

12. (a)



Total distance covered in 10 s = Area 1 + Area 2 + Area 3

$$\Rightarrow \frac{1}{2} \times 20 + \times 2 \frac{1}{2} \times 20 + \times 2 \frac{1}{2} \times 10 = 90 \text{ m}$$

Total displacement in 10s = Area 1 – Area 2 + Area 3

$$\Rightarrow \frac{1}{2} \times 6 \times 20 - \frac{1}{2} \times 2 \times 20 + \frac{1}{2} \times 2 \times 10 = 50 m$$

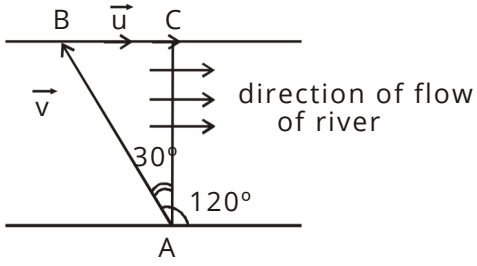
13. (c) In a uniform electric field, net force = 0, but torque ¹ 0.

14. (c) Let the speed of water = u

Speed of swimmer = v = 0.5 m/sec

Angle between $\vec{v}$ and $\vec{u}$ is 120°. Then

$$\sin\theta = \frac{u}{v} \Rightarrow \frac{u}{0.5} = \frac{1}{2} \text{ or } u = 0.25 \text{ ms}^{-1}$$



15. (a) Radius of drop, r = 0.3 mm = 0.03 cm

Terminal velocity, v = 1 m/s = 100 cm/sec

Viscosity of air, h = 8 × 10–5 poise

Viscous force, f = 6 phrv

F = 6 × 3.14 × (8 ×10–5) × 0.03 ×100 = 4.52 ×10–3 dyne

16. (d) Rate of transmission of heat

$$= \frac{\text{Temperature difference}}{\text{Thermal Resistance}}$$

$$\therefore \frac{dQ}{dt} = \frac{dq}{R}$$

$$(q-q_2)$$

Here, $\frac{dQ}{dt} = \frac{}{R_2} = \frac{q_1 - q}{R_1}$

$$\Rightarrow \frac{q-q_2}{R_2} = \frac{q_1-q}{R_1}$$

$$\Rightarrow R_1 q - R_1 q_2 = R_2 q_1 - R_2 q$$

$$\Rightarrow q(R_1 + R_2) = R_2 q_1 + R_1 q_2$$

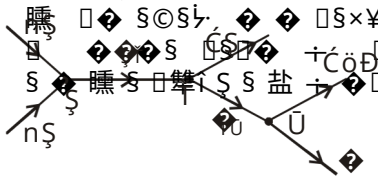
$$\therefore q = \frac{(R_2 q_1 + R_1 q_2)}{(R_1 + R_2)}$$

17. (b)

18. (b)

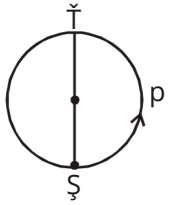
19. (c)

20. (a)



21. (d)

22. (b)



23. (b)

24. (b)

25. (b)

26. (d)

27. (a)

28. (b)

瞟□竈 = 笨×笨竈 $\left(\frac{n}{n}\right)^{n}$ + 笨竈$_{\div 竈}$

Þ ÷竈$\sqrt{\dot{E}}$ ú Ð

29. (c) □ § □÷ ⊢§Şî
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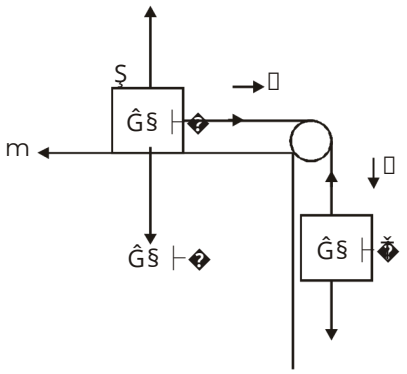

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Þ §©§ĐĢöÎĜ î§§□§©§nöĖĜ§竈ú瞟□÷n

30. (b) 和 □瞟瞟§©§和 □瞟瞟$\frac{\dot{C}}{\pi^{n}}$

$\frac{S_B}{S_A} = \left(\frac{r_A}{r_B}\right)^{n} = \times nÝ$þ S_B $\dot{E}S_A$

31. (b) □§ □□ □竈§□ §÷□ § 盐§ 渺§§瞟§ □ § ö
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§§§

$\frac{np}{\sqrt{n}}$

$= \frac{np}{\sqrt{n}} = p\sqrt{n}$

36. (c)

$$\text{Mean} = \frac{\Sigma}{n}$$

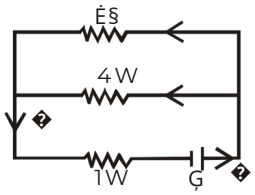
$$\text{Variance} = \frac{\Sigma}{N}$$

$$\text{S.D.} = \sqrt{\text{Variance}} = \frac{\Sigma}{N}$$

$$\frac{\Sigma}{N} = n \cdot \frac{\Sigma}{N} = n$$

37. (d)

$$= \frac{\Sigma}{\Sigma} = \frac{CG}{l} = nW$$



38. (c)

$$\text{Mean} = \frac{\Sigma}{n}$$

$$\text{Variance} = \frac{\Sigma}{N}$$

$$\text{S.D.} = \sqrt{\text{Variance}} = \frac{\Sigma}{N}$$

39. (b)

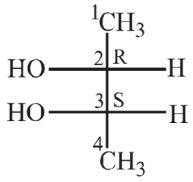
$$b = \frac{\Sigma}{\Sigma} = nb$$

40. (a)

PART - II (CHEMISTRY)

41. (b)

42. (a)



43. (b)

44. (b)

45. (b) $N_2 + 3H_2 \rightarrow 2NH_3$

$$-\frac{\Delta[N_2]}{\Delta t} = -\frac{1}{3}\frac{\Delta[H_2]}{\Delta t} = \frac{1}{2}\frac{\Delta[NH_3]}{\Delta t}$$

$$\therefore -\frac{\Delta[H_2]}{\Delta t} = \frac{2}{3} \times \frac{\Delta[NH_3]}{\Delta t} = \frac{3}{2} \times 2 \times 10^{-4}$$

$$= 3 \times 10^{-4} \text{ mol } L^{-1} S^{-1}$$

46. (a) $K_p = K_c [RT]^{\Delta n_g}$ $\Delta n = 2 - 4 = -2$

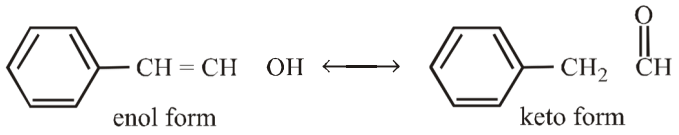
$T = 673K$, $K_c = 0.5$,

$R = 0.082$ L. atm. $^{-1}$ mol^{-1} K

$K_p = 0.5 \times (0.082 \times 673)^{-2}$

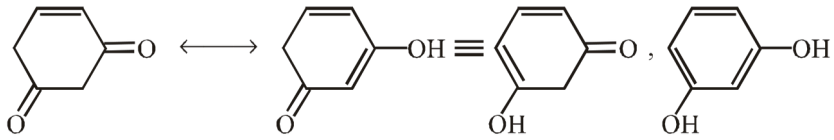
$= 1.64 \times 10^{-4}$ atm.

47. (d) (a)



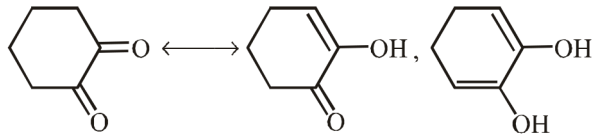
enol form keto form

(b)



keto form enol form

(c)



keto form enol form

(d)

cannot tautomerise

48. (b) $Cu^{2+} + 1e^- \rightarrow Cu^+$; $\Delta G_1^\circ = -n_1 E_1^\circ F$

$= -$

$Cu^+ + 1e^- \rightarrow Cu$; $\Delta G_2^\circ = -n_2 E_2^\circ F$

$Cu^{2+} + 2e^- \rightarrow Cu$ $\Delta G^\circ = \Delta G_1^\circ + \Delta G_2^\circ$

$-nE^\circ F = -n_1 E_1^\circ F + (-n_2 E_2^\circ F)$

$-nE^\circ F = -F(n_1 E_1^\circ + n_2 E_2^\circ)$

$$E^\circ = \frac{n_1 E_1^\circ + n_2 E_2^\circ}{n} = \frac{0.15 \times 1 + 0.50 \times 1}{2} = 0.325$$

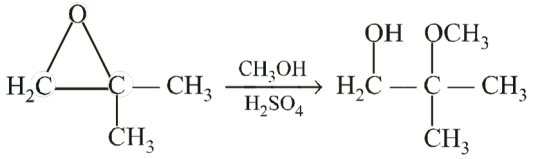
49. (b) An oxygen- helium mixture is used for artificial respiration in deep sea diving instead of air because nitrogen present in air dissolves in blood under high pressure when sea diver goes into deep sea. When he comes to the surface nitrogen bubbles out of the blood due to decrease in pressure, causing pain. This disease is called "bends".

50. (d) $E_1 = \frac{hc}{\lambda_1}$, $E_2 = \frac{hc}{\lambda_2}$

$$\frac{E_1}{E_2} = \frac{hc}{\lambda_1} \times \frac{\lambda_2}{hc} = \frac{\lambda_2}{\lambda_1} = \frac{4000}{2000} = 2$$

51. (c)

52. (a)



53. (c)

54. (a)

55. (d)

56. (a)

57. (a)

58. (b)

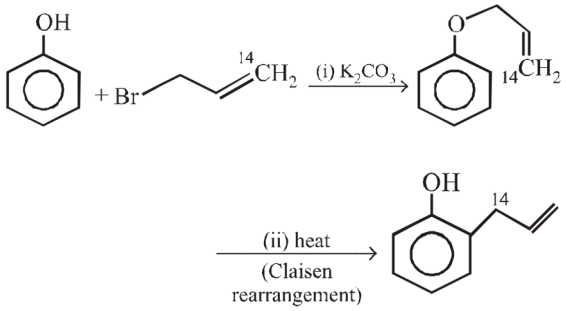
59. (c)

60. (c)

61. (c)

62. (c)

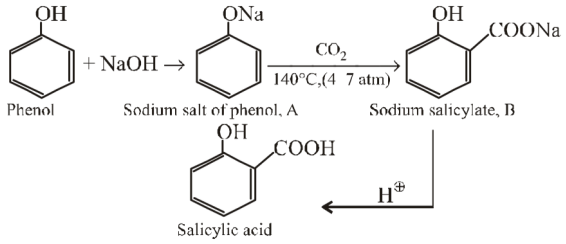
63. (b)



64. (b)

65. (b)

66. (d)

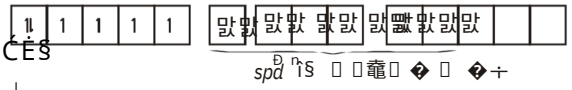


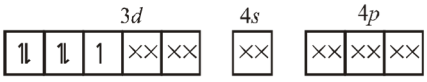
67. (b)

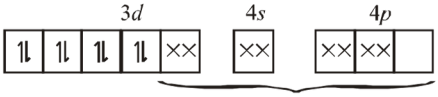
68. (a)

69. (a)

70. (a)



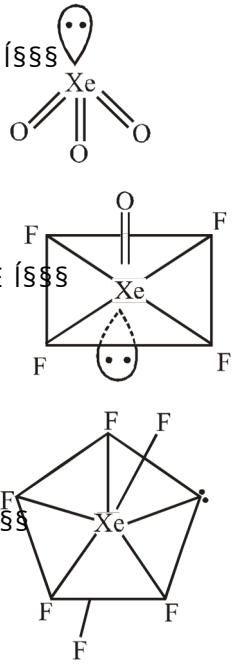




71. (b)

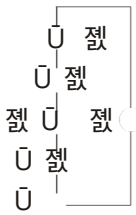
72. (b)

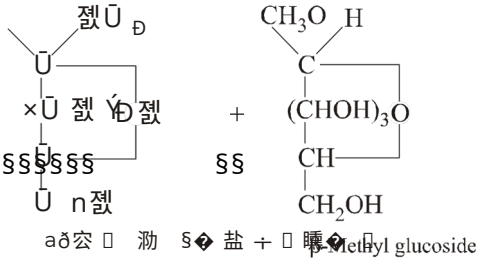
73. (d)



74. (a)

75. (c)





76. (d)

77. (b)

78. (a)

79. (c)

PART - III (MATHEMETICS)

88. (c) $y = \left(-\frac{\dot{E}x}{\acute{C}+\hat{G}n}\right) + \left(-\frac{\acute{C}n+\eth x}{\eth - nx}\right)$

$= \left(-\frac{\hat{G}x - x}{\acute{C}+\hat{G}x \times x}\right) + \left(-\frac{\eth + x}{\acute{C}-n}\right)$

$= \left(-\acute{C}\hat{G}x - \left(-\acute{C}_x\right) + \left(-\frac{\acute{C}n}{\eth}\right) + \left(-\acute{C}_x\right)\right.$

$\therefore \frac{dy}{dx} = \frac{\hat{G}}{\acute{C}+n\hat{G}x}$

89. (c)

90. (d)

91. (a)

92. (a)

93. (c)

$L = \lim_{x \to 0} \ldots$

$L = \lim_{t \to 0} \ldots$

$= \frac{2}{3} \lim_{t \to 0} \ldots$

94. (d) $V = \pi r^2 h$

$\frac{dV}{dt} = \pi \left(r^2 \frac{dh}{dt} + 2rh \frac{dr}{dt} \right)$

$\frac{dr}{dt} = \ldots, \quad \frac{dh}{dt} = -\frac{2}{\ldots}$

$\frac{dV}{dt} = \pi \left(\ldots \right) = \frac{\pi r}{5}(\ldots r + h)$

$\frac{dV}{dt} = \frac{\pi \times 2}{5}(\ldots)$

95. (c)

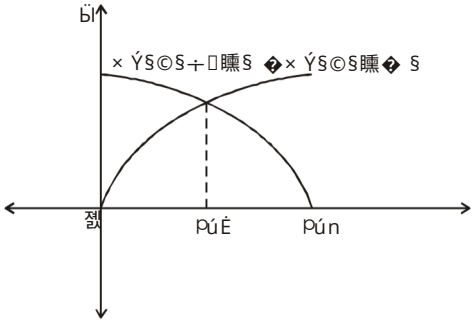
96. (a)

97. (c)

98. (b)

99. (d)

100. (b)



101. (c)

102. (a)

103. (b)

104. (d)

105. (b)

106. (b)

107. (b)

108. (c)

109. (a)

110. (d)

111. (a)

112. (c)

On integrating, we get

$$x - \frac{y^2}{2} + \frac{1}{2}\int \sqrt{t}\,dt = C, \quad t = \sqrt{x^2 + y^2}$$

$$\text{or } x - \frac{y^2}{2} + \frac{1}{3}\left(x^2 + y^2\right)^{3/2} = C$$

113. (c) Since $x\frac{dy}{dx} - y = x^4 - 3x$

$$\therefore \quad \frac{dy}{dx} - \frac{y}{x} = x^3 - 3$$

Hence

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

114. (b) $P(A) = 1/4$, $P(A/B) = \frac{1}{2}$, $P(B/A) = 2/3$

By conditional probability,

$P(A \cap B) = P(A)\,P(B/A) = P(B)P(A/B)$

$$\Rightarrow \frac{1}{4}\cdot\frac{2}{3} = P(B)\cdot\frac{1}{2} \Rightarrow P(B) = \frac{1}{3}$$

115. (d) We have, $f(x) = 2x - 3$, $g(x) = x^3 + 5$

$(fog)x = f(x^3 + 5) = 2(x^3 + 5) - 3 = 2x^3 + 7$

Let $y = (fog)x = 2x^3 + 7$

$$\Rightarrow x = \left(\frac{y-7}{2}\right)^{1/3} \Rightarrow (fog)^{-1}x = \left(\frac{x-7}{2}\right)^{1/3}$$

116. (c) The inverse of the proposition $(p \wedge \sim q) \to r$ is

$\sim (p \wedge \sim q) \to \sim r \equiv \sim p \vee \sim(\sim q) \to \sim r$

$\equiv \sim p \vee q \to \sim r$

117. (d) (i) $f(x) = \sqrt{x}$ is continuous in $[4, 9]$

(ii)

$$f'(x) = \frac{1}{2\sqrt{x}}$$

Thus $f(x)$ is differentiable in $(4, 9)$

(iii) $f(4) \neq f(9)$. All the three conditions of LMV theorem satisfied then there exist at least one $c \in (4, 9)$ such that.

$$f'(c) = \frac{f(b) - f(a)}{b - a} \Rightarrow \frac{1}{2\sqrt{c}} = \frac{1}{5} \Rightarrow c = \frac{25}{4}$$

118. (b) We have

$$|x+1| + |x| = \begin{cases} -x - (x-1) = -2x+1, & \text{if } x \le 0 \\ x - (x-1) = 1, & \text{if } 0 \le x \le 1 \\ x + x - 1 = 2x - 1, & \text{if } x \ge 1 \end{cases}$$

$$\therefore \int_{-1}^{3} (|x| + |x-1|)\,dx$$

$$= \int_{-1}^{0} (-2x+1)\,dx + \int_{0}^{1} 1\,dx + \int_{1}^{3} (2x-1)\,dx$$

$$= \left[-x^2 + x\right]_{-1}^{0} + [x]_0^1 + \left[x^2 - x\right]_1^3 = 9$$

119. (c) a, b, c are in A.P. $\Rightarrow 2b = a + c$

Now,

$$e^{1/c} \cdot e^{1/a} = e^{(a+c)/ac} = e^{2b/ac} = (e^{b/ac})^2$$

$\therefore e^{1/c}, e^{b/ac}, e^{1/a}$ in G.P. with common ratio

$$= \frac{e^{b/ac}}{e^{1/c}} = e^{(b-a)/ac} = e^{d/(b^2 - d^2)}$$

[Q a, b, c are in A.P. with common difference $d \Rightarrow b - a = c - b = d$]

120. (a) We have $T_2 = {}^{14}C_1 a^{\frac{5}{2}}$

$$\Rightarrow {}^{n}C_1 (a^{\frac{1}{13}})^{n-1} (a^{\frac{3}{2}}) = 14a^{\frac{5}{2}}$$

$$\Rightarrow n a^{\frac{n-1}{13} + \frac{3}{2}} = 14a^{\frac{5}{2}} \qquad n = 14$$

$$\therefore \frac{{}^{n}C_3}{{}^{4}C_3} = \frac{{}^{14}C_1}{{}^{4}C_3} = \frac{12}{3} = 4$$

PART - IV (ENGLISH)

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