

# National Testing Agency

<b>Question Paper Name :</b>	B TECH 17th March 2021 Shift 1
<b>Subject Name :</b>	B TECH
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<b>Total Marks :</b>	300
<b>Display Marks:</b>	Yes

## B TECH

<b>Group Number :</b>	1
<b>Group Id :</b>	86435138
<b>Group Maximum Duration :</b>	0
<b>Group Minimum Duration :</b>	180
<b>Show Attended Group? :</b>	No
<b>Edit Attended Group? :</b>	No
<b>Break time :</b>	0
<b>Group Marks :</b>	300
<b>Is this Group for Examiner? :</b>	No

## Physics Section A

<b>Section Id :</b>	864351223
<b>Section Number :</b>	1
<b>Section type :</b>	Online
<b>Mandatory or Optional :</b>	Mandatory
<b>Number of Questions :</b>	20
<b>Number of Questions to be attempted :</b>	20
<b>Section Marks :</b>	80
<b>Mark As Answered Required? :</b>	Yes
<b>Sub-Section Number :</b>	1
<b>Sub-Section Id :</b>	864351223
<b>Question Shuffling Allowed :</b>	Yes

**Question Number : 1 Question Id : 8643513331 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1**

A car accelerates from rest at a constant rate  $\alpha$  for some time after which it decelerates at a constant rate  $\beta$  to come to rest. If the total time elapsed is  $t$  seconds, the total distance travelled is :

Options :

8643519991.  $\frac{2\alpha\beta}{(\alpha + \beta)} t^2$

8643519992.  $\frac{\alpha\beta}{2(\alpha + \beta)} t^2$

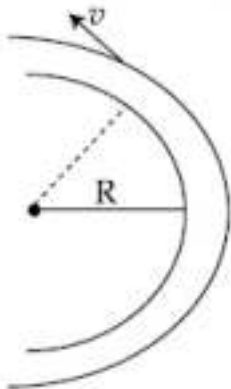
8643519993.  $\frac{4\alpha\beta}{(\alpha + \beta)} t^2$

8643519994.  $\frac{\alpha\beta}{4(\alpha + \beta)} t^2$

Question Number : 2 Question Id : 8643513332 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

A modern grand - prix racing car of mass  $m$  is travelling on a flat track in a circular arc of radius  $R$  with a speed  $v$ . If the coefficient of static friction between the tyres and the track is  $\mu_s$ , then the magnitude of negative lift  $F_L$  acting downwards on the car is : (Assume forces on the four tyres are identical and  $g$  = acceleration due to gravity)



Options :

8643519995.  $m\left(\frac{v^2}{\mu_s R} + g\right)$

8643519996.  $m\left(g - \frac{v^2}{\mu_s R}\right)$

8643519997.  $m\left(\frac{v^2}{\mu_s R} - g\right)$

8643519998.  $-m\left(g + \frac{v^2}{\mu_s R}\right)$

**Question Number : 3 Question Id : 8643513333 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

A Carnot's engine working between 400 K and 800 K has a work output of 1200 J per cycle. The amount of heat energy supplied to the engine from the source in each cycle is :

**Options :**

8643519999. 2400 J

86435110000. 1600 J

86435110001. 3200 J

86435110002. 1800 J

**Question Number : 4 Question Id : 8643513334 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

A solenoid of 1000 turns per metre has a core with relative permeability 500. Insulated windings of the solenoid carry an electric current of 5 A. The magnetic flux density produced by the solenoid is : (permeability of free space =  $4\pi \times 10^{-7}$  H/m)

**Options :**

86435110003.  $10^{-4}\pi$  T

86435110004.  $2 \times 10^{-3}\pi$  T

86435110005.  $\frac{\pi}{5} T$

86435110006.  $\pi T$

**Question Number : 5 Question Id : 8643513335 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

A current of 10 A exists in a wire of crosssectional area of 5 mm<sup>2</sup> with a drift velocity of  $2 \times 10^{-3} \text{ ms}^{-1}$ . The number of free electrons in each cubic meter of the wire is \_\_\_\_\_.

**Options :**

86435110007.  $2 \times 10^6$

86435110008.  $1 \times 10^{23}$

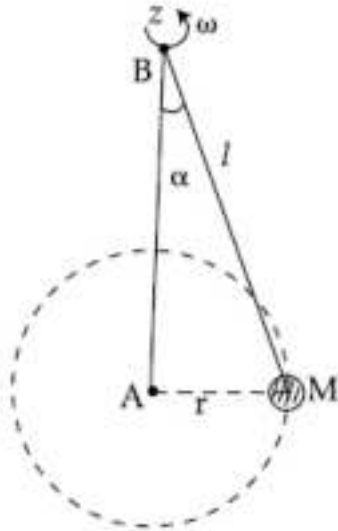
86435110009.  $625 \times 10^{25}$

86435110010.  $2 \times 10^{25}$

**Question Number : 6 Question Id : 8643513336 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

A mass  $M$  hangs on a massless rod of length  $l$  which rotates at a constant angular frequency. The mass  $M$  moves with steady speed in a circular path of constant radius. Assume that the system is in steady circular motion with constant angular velocity  $\omega$ . The angular momentum of  $M$  about point  $A$  is  $L_A$  which lies in the positive  $z$  direction and the angular momentum of  $M$  about point  $B$  is  $L_B$ . The correct statement for this system is :



Options :

86435110011.  $L_A$  and  $L_B$  are both constant in magnitude and direction
86435110012.  $L_A$  is constant, both in magnitude and direction
86435110013.  $L_B$  is constant, both in magnitude and direction
86435110014.  $L_B$  is constant in direction with varying magnitude

Question Number : 7 Question Id : 8643513337 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

An AC current is given by  $I = I_1 \sin \omega t + I_2 \cos \omega t$ . A hot wire ammeter will give a reading :

Options :

86435110015.  $\frac{I_1 + I_2}{\sqrt{2}}$

86435110016.  $\frac{I_1 + I_2}{2\sqrt{2}}$

$$86435110017. \sqrt{\frac{I_1^2 + I_2^2}{2}}$$

$$86435110018. \sqrt{\frac{I_1^2 - I_2^2}{2}}$$

**Question Number : 8 Question Id : 8643513338 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

A polyatomic ideal gas has 24 vibrational modes. What is the value of  $\gamma$  ?

**Options :**

$$86435110019. 10.3$$

$$86435110020. 1.30$$

$$86435110021. 1.03$$

$$86435110022. 1.37$$

**Question Number : 9 Question Id : 8643513339 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

When two soap bubbles of radii  $a$  and  $b$  ( $b > a$ ) coalesce, the radius of curvature of common surface is :

**Options :**

$$86435110023. \frac{ab}{b - a}$$

$$86435110024. \frac{ab}{a + b}$$

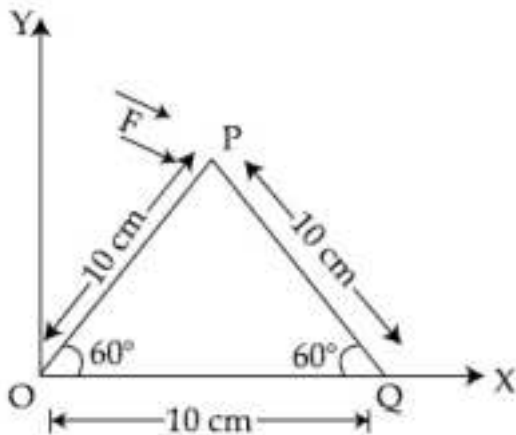
$$86435110025. \frac{b - a}{ab}$$

$$86435110026. \frac{a + b}{ab}$$

Question Number : 10 Question Id : 8643513340 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

A triangular plate is shown. A force  $\vec{F} = 4\hat{i} - 3\hat{j}$  is applied at point P. The torque at point P with respect to point 'O' and 'Q' are :



Options :

86435110027.  $-15 - 20\sqrt{3}, 15 - 20\sqrt{3}$

86435110028.  $15 + 20\sqrt{3}, 15 - 20\sqrt{3}$

86435110029.  $15 - 20\sqrt{3}, 15 + 20\sqrt{3}$

86435110030.  $-15 + 20\sqrt{3}, 15 + 20\sqrt{3}$

Question Number : 11 Question Id : 8643513341 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

Two identical metal wires of thermal conductivities  $K_1$  and  $K_2$  respectively are connected in series. The effective thermal conductivity of the combination is :

Options :

$$\frac{K_1 K_2}{K_1 + K_2}$$

86435110031.

$$86435110032. \quad \frac{2K_1 K_2}{K_1 + K_2}$$

$$86435110033. \quad \frac{K_1 + K_2}{2K_1 K_2}$$

$$86435110034. \quad \frac{K_1 + K_2}{K_1 K_2}$$

**Question Number : 12 Question Id : 8643513342 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

A boy is rolling a 0.5 kg ball on the frictionless floor with the speed of  $20 \text{ ms}^{-1}$ . The ball gets deflected by an obstacle on the way. After deflection it moves with 5% of its initial kinetic energy. What is the speed of the ball now ?

**Options :**

$$86435110035. \quad 1.00 \text{ ms}^{-1}$$

$$86435110036. \quad 4.47 \text{ ms}^{-1}$$

$$86435110037. \quad 14.41 \text{ ms}^{-1}$$

$$86435110038. \quad 19.0 \text{ ms}^{-1}$$

**Question Number : 13 Question Id : 8643513343 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

The thickness at the centre of a plano convex lens is 3 mm and the diameter is 6 cm. If the speed of light in the material of the lens is  $2 \times 10^8 \text{ ms}^{-1}$ . The focal length of the lens is \_\_\_\_\_.

**Options :**

$$86435110039. \quad 30 \text{ cm}$$

$$86435110040. \quad 15 \text{ cm}$$

$$86435110041. \quad 1.5 \text{ cm}$$



86435110042. 0.30 cm

**Question Number : 14 Question Id : 8643513344 Question Type : MCQ Option Shuffling : Yes Is****Question Mandatory : No****Correct Marks : 4 Wrong Marks : 1**

Which level of the single ionized carbon has the same energy as the ground state energy of hydrogen atom ?

**Options :**

86435110043. 1

86435110044. 4

86435110045. 6

86435110046. 8

**Question Number : 15 Question Id : 8643513345 Question Type : MCQ Option Shuffling : Yes Is****Question Mandatory : No****Correct Marks : 4 Wrong Marks : 1**

Two ideal polyatomic gases at temperatures  $T_1$  and  $T_2$  are mixed so that there is no loss of energy. If  $F_1$  and  $F_2$ ,  $m_1$  and  $m_2$ ,  $n_1$  and  $n_2$  be the degrees of freedom, masses, number of molecules of the first and second gas respectively, the temperature of mixture of these two gases is :

**Options :**86435110047. 
$$\frac{n_1 F_1 T_1 + n_2 F_2 T_2}{n_1 + n_2}$$
86435110048. 
$$\frac{n_1 F_1 T_1 + n_2 F_2 T_2}{F_1 + F_2}$$
86435110049. 
$$\frac{n_1 F_1 T_1 + n_2 F_2 T_2}{n_1 F_1 + n_2 F_2}$$
86435110050. 
$$\frac{n_1 T_1 + n_2 T_2}{n_1 + n_2}$$

**Question Number : 16 Question Id : 8643513346 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

For what value of displacement the kinetic energy and potential energy of a simple harmonic oscillation become equal ?

**Options :**

86435110051.  $x = \pm A$

86435110052.  $x = 0$

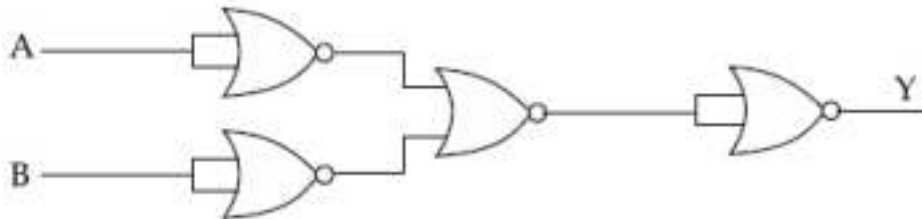
86435110053.  $x = \pm \frac{A}{\sqrt{2}}$

86435110054.  $x = \frac{A}{2}$

**Question Number : 17 Question Id : 8643513347 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

The output of the given combination gates represents :



**Options :**

86435110055. AND Gate

86435110056. NOR Gate

86435110057. NAND Gate

86435110058. XOR Gate

**Question Number : 18 Question Id : 8643513348 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

An electron of mass  $m$  and a photon have same energy  $E$ . The ratio of wavelength of electron to that of photon is : ( $c$  being the velocity of light)

**Options :**

86435110059.  $\left(\frac{E}{2m}\right)^{1/2}$

86435110060.  $c(2mE)^{1/2}$

86435110061.  $\frac{1}{c}\left(\frac{2m}{E}\right)^{1/2}$

86435110062.  $\frac{1}{c}\left(\frac{E}{2m}\right)^{1/2}$

**Question Number : 19 Question Id : 8643513349 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

The vernier scale used for measurement has a positive zero error of 0.2 mm. If while taking a measurement it was noted that '0' on the vernier scale lies between 8.5 cm and 8.6 cm, vernier coincidence is 6, then the correct value of measurement is \_\_\_\_\_ cm. (least count = 0.01 cm)

**Options :**

86435110063. 8.58 cm

86435110064. 8.56 cm

86435110065. 8.54 cm

86435110066. 8.36 cm

**Question Number : 20 Question Id : 8643513350 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

If an electron is moving in the  $n^{\text{th}}$  orbit of the hydrogen atom, then its velocity ( $v_n$ ) for the  $n^{\text{th}}$  orbit is given as :

**Options :**

86435110067.  $v_n \propto n^2$

86435110068.  $v_n \propto n$

86435110069.  $v_n \propto \frac{1}{n^2}$

86435110070.  $v_n \propto \frac{1}{n}$

## Physics Section B

<b>Section Id :</b>	864351224
<b>Section Number :</b>	2
<b>Section type :</b>	Online
<b>Mandatory or Optional :</b>	Mandatory
<b>Number of Questions :</b>	10
<b>Number of Questions to be attempted :</b>	5
<b>Section Marks :</b>	20
<b>Mark As Answered Required? :</b>	Yes
<b>Sub-Section Number :</b>	1
<b>Sub-Section Id :</b>	864351224
<b>Question Shuffling Allowed :</b>	Yes

**Question Number : 21 Question Id : 8643513351 Question Type : SA**

**Correct Marks : 4 Wrong Marks : 0**

For VHF signal broadcasting, \_\_\_\_\_  $\text{km}^2$  of maximum service area will be covered by an antenna tower of height 30 m, if the receiving antenna is placed at ground. Let radius of the earth be 6400 km. (Round off to the Nearest Integer) (Take  $\pi$  as 3.14)

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

100

**Question Number : 22 Question Id : 8643513352 Question Type : SA**

**Correct Marks : 4 Wrong Marks : 0**

If  $2.5 \times 10^{-6}$  N average force is exerted by a light wave on a non - reflecting surface of  $30 \text{ cm}^2$  area during 40 minutes of time span, the energy flux of light just before it falls on the surface is \_\_\_\_\_  $\text{W/cm}^2$ . (Round off to the Nearest Integer)

(Assume complete absorption and normal incidence conditions are there)

**Response Type : Numeric**

**Evaluation Required For SA : Yes**

**Show Word Count : Yes**

**Answers Type : Equal**

**Text Areas : PlainText**

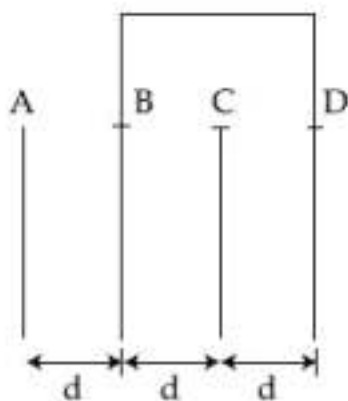
**Possible Answers :**

100

**Question Number : 23 Question Id : 8643513353 Question Type : SA**

**Correct Marks : 4 Wrong Marks : 0**

Four identical rectangular plates with length,  $l = 2$  cm and breadth,  $b = \frac{3}{2}$  cm are arranged as shown in figure. The equivalent capacitance between A and C is  $\frac{x\epsilon_0}{d}$ . The value of x is \_\_\_\_\_ . (Round off to the Nearest Integer)



**Response Type : Numeric**

**Evaluation Required For SA : Yes**

**Show Word Count : Yes**

**Answers Type : Equal**

**Text Areas : PlainText**

**Possible Answers :**

100

**Question Number : 24 Question Id : 8643513354 Question Type : SA**

**Correct Marks : 4 Wrong Marks : 0**

The equivalent resistance of series combination of two resistors is 's'. When they are connected in parallel, the equivalent resistance is 'p'. If  $s = np$ , then the minimum value for n is \_\_\_\_\_. (Round off to the Nearest Integer)

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

100

**Question Number : 25 Question Id : 8643513355 Question Type : SA**

**Correct Marks : 4 Wrong Marks : 0**

A parallel plate capacitor whose capacitance C is 14 pF is charged by a battery to a potential difference  $V = 12$  V between its plates. The charging battery is now disconnected and a porcelain plate with  $k = 7$  is inserted between the plates, then the plate would oscillate back and forth between the plates with a constant mechanical energy of \_\_\_\_\_ pJ.

(Assume no friction)

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

100

**Question Number : 26 Question Id : 8643513356 Question Type : SA**

**Correct Marks : 4 Wrong Marks : 0**

The radius in kilometer to which the present radius of earth ( $R = 6400$  km) to be compressed so that the escape velocity is increased 10 times is \_\_\_\_\_ .

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

100

**Question Number : 27 Question Id : 8643513357 Question Type : SA**

**Correct Marks : 4 Wrong Marks : 0**

The angular speed of truck wheel is increased from 900 rpm to 2460 rpm in 26 seconds. The number of revolutions by the truck engine during this time is \_\_\_\_\_.

(Assuming the acceleration to be uniform).

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

100

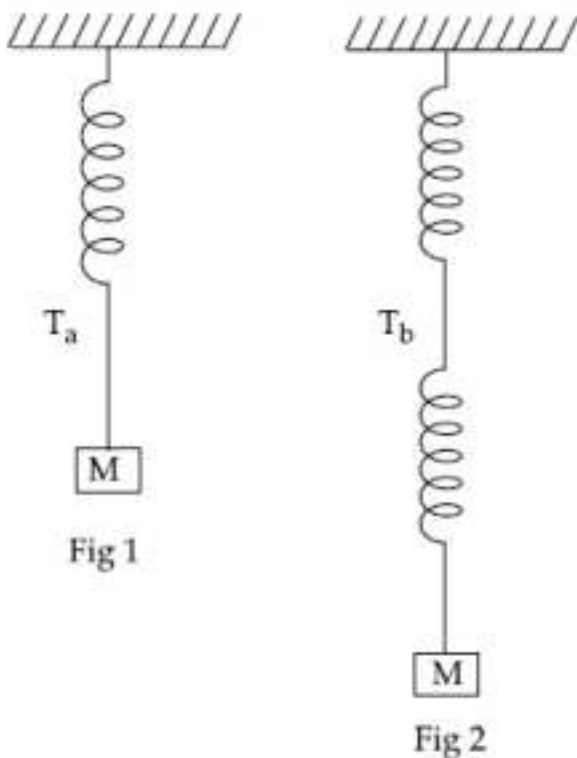
**Question Number :** 28 **Question Id :** 8643513358 **Question Type :** SA

**Correct Marks :** 4 **Wrong Marks :** 0

Consider two identical springs each of spring constant  $k$  and negligible mass compared to the mass  $M$  as shown. Fig. 1 shows one of them and Fig. 2 shows their series combination.

The ratios of time period of oscillation of the two SHM is  $T_b/T_a = \sqrt{x}$ , where value of  $x$  is

\_\_\_\_\_. (Round off to the Nearest Integer)



**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

100

**Question Number : 29 Question Id : 8643513359 Question Type : SA**

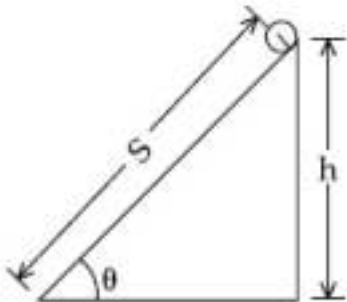
**Correct Marks : 4 Wrong Marks : 0**

The following bodies,

- (1) a ring
- (2) a disc
- (3) a solid cylinder
- (4) a solid sphere,

of same mass ' $m$ ' and radius ' $R$ ' are allowed to roll down without slipping simultaneously from the top of the inclined plane. The body which will reach first at the bottom of the inclined plane is \_\_\_\_\_.

[Mark the body as per their respective numbering given in the question]



**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

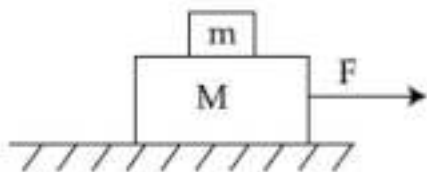
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**Question Number : 30 Question Id : 8643513360 Question Type : SA**

**Correct Marks : 4 Wrong Marks : 0**



Two blocks ( $m=0.5$  kg and  $M=4.5$  kg) are arranged on a horizontal frictionless table as shown in figure. The coefficient of static friction between the two blocks is  $\frac{3}{7}$ . Then the maximum horizontal force that can be applied on the larger block so that the blocks move together is \_\_\_\_\_ N. (Round off to the Nearest Integer) [Take  $g$  as  $9.8$   $\text{ms}^{-2}$ ]



**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

100

## Chemistry Section A

<b>Section Id :</b>	864351225
<b>Section Number :</b>	3
<b>Section type :</b>	Online
<b>Mandatory or Optional :</b>	Mandatory
<b>Number of Questions :</b>	20
<b>Number of Questions to be attempted :</b>	20
<b>Section Marks :</b>	80
<b>Mark As Answered Required? :</b>	Yes
<b>Sub-Section Number :</b>	1
<b>Sub-Section Id :</b>	864351225
<b>Question Shuffling Allowed :</b>	Yes

**Question Number : 31 Question Id : 8643513361 Question Type : MCQ Option Shuffling : Yes Is**

**Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

A central atom in a molecule has two lone pairs of electrons and forms three single bonds. The shape of this molecule is :

**Options :**

86435110081. planar triangular

86435110082. T-shaped

86435110083. see-saw

86435110084. trigonal pyramidal

**Question Number : 32 Question Id : 8643513362 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

A colloidal system consisting of a gas dispersed in a solid is called a/an :

**Options :**

86435110085. aerosol

86435110086. solid sol

86435110087. foam

86435110088. gel

**Question Number : 33 Question Id : 8643513363 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

The absolute value of the electron gain enthalpy of halogens satisfies :

**Options :**

86435110089.  $F > Cl > Br > I$

86435110090.  $Cl > F > Br > I$

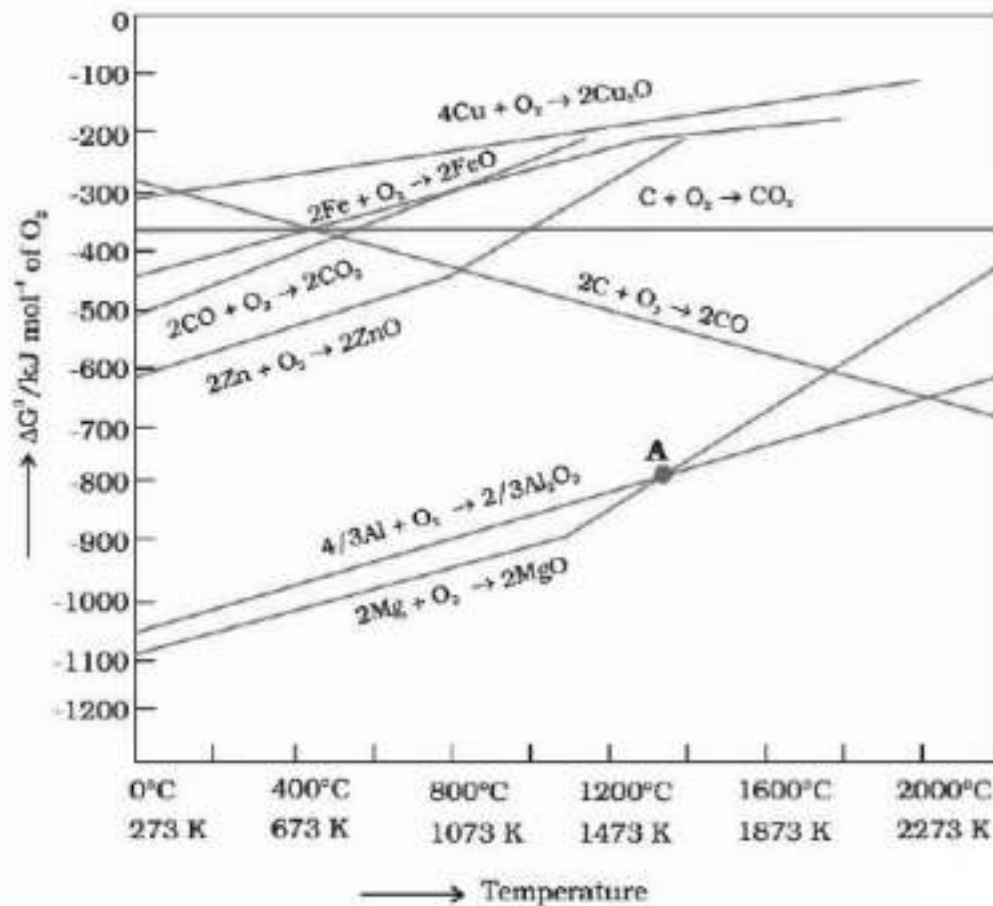
86435110091.  $Cl > Br > F > I$

86435110092.  $I > Br > Cl > F$

**Question Number : 34 Question Id : 8643513364 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

The point of intersection and sudden increase in the slope, in the diagram given below, respectively, indicates :



Options :

86435110093.  $\Delta G < 0$  and decomposition of the metal oxide
86435110094.  $\Delta G > 0$  and decomposition of the metal oxide
86435110095.  $\Delta G = 0$  and melting or boiling point of the metal oxide
86435110096.  $\Delta G = 0$  and reduction of the metal oxide

Question Number : 35 Question Id : 8643513365 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Correct Marks : 4 Wrong Marks : 1

The **INCORRECT** statement(s) about heavy water is (are)

- (A) used as a moderator in nuclear reactor
- (B) obtained as a by-product in fertilizer industry
- (C) used for the study of reaction mechanism
- (D) has a higher dielectric constant than water

Choose the correct answer from the options given below :

**Options :**

86435110097. (C) only

86435110098. (B) only

86435110099. (D) only

86435110100. (B) and (D) only

**Question Number : 36 Question Id : 8643513366 Question Type : MCQ Option Shuffling : Yes Is**

**Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

The correct order of conductivity of ions in water is :

**Options :**

86435110101.  $\text{Cs}^+ > \text{Rb}^+ > \text{K}^+ > \text{Na}^+$

86435110102.  $\text{Na}^+ > \text{K}^+ > \text{Rb}^+ > \text{Cs}^+$

86435110103.  $\text{K}^+ > \text{Na}^+ > \text{Cs}^+ > \text{Rb}^+$

86435110104.  $\text{Rb}^+ > \text{Na}^+ > \text{K}^+ > \text{Li}^+$

**Question Number : 37 Question Id : 8643513367 Question Type : MCQ Option Shuffling : Yes Is**

**Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

Which of the following compound **CANNOT** act as a Lewis base ?

**Options :**

86435110105.  $\text{ClF}_3$

86435110106.  $\text{PCl}_5$

86435110107.  $\text{NF}_3$ 86435110108.  $\text{SF}_4$ **Question Number : 38 Question Id : 8643513368 Question Type : MCQ Option Shuffling : Yes Is****Question Mandatory : No****Correct Marks : 4 Wrong Marks : 1**

What is the spin-only magnetic moment value (BM) of a divalent metal ion with atomic number 25, in its aqueous solution ?

**Options :**

86435110109. 5.0

86435110110. 5.26

86435110111. 5.92

86435110112. zero

**Question Number : 39 Question Id : 8643513369 Question Type : MCQ Option Shuffling : Yes Is****Question Mandatory : No****Correct Marks : 4 Wrong Marks : 1**

Given below are two statements :

Statement I : Potassium permanganate on heating at 573 K forms potassium manganate.

Statement II : Both potassium permanganate and potassium manganate are tetrahedral and paramagnetic in nature.

In the light of the above statements, choose the most appropriate answer from the options given below :

**Options :**

86435110113. Both statement I and statement II are false

86435110114. Both statement I and statement II are true

86435110115. Statement I is true but statement II is false

86435110116. Statement I is false but statement II is true

**Question Number : 40 Question Id : 8643513370 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

Reducing smog is a mixture of :

**Options :**

86435110117. Smoke, fog and  $O_3$

86435110118. Smoke, fog and  $SO_2$

86435110119. Smoke, fog and  $N_2O_3$

86435110120. Smoke, fog and  $CH_2=CH-CHO$

**Question Number : 41 Question Id : 8643513371 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

Given below are two statements :

Statement I : Retardation factor ( $R_f$ ) can be measured in meter/centimeter.

Statement II :  $R_f$  value of a compound remains constant in all solvents.

Choose the most appropriate answer from the options given below :

**Options :**

86435110121. Both statement I and statement II are true

86435110122. Both statement I and statement II are false

86435110123. Statement I is true but statement II is false

86435110124. Statement I is false but statement II is true

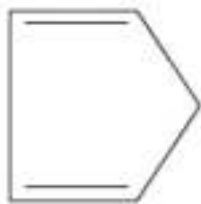
**Question Number : 42 Question Id : 8643513372 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

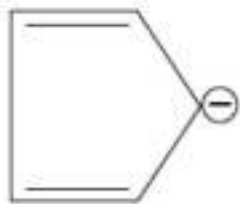
Which of the following is an aromatic compound ?

**Options :**

86435110125.



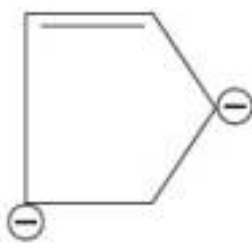
86435110126.



86435110127.

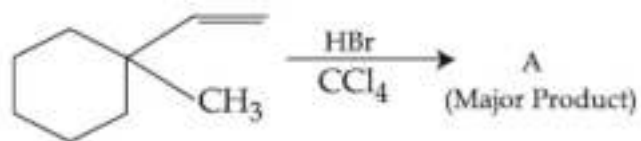


86435110128.



**Question Number : 43 Question Id : 8643513373 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

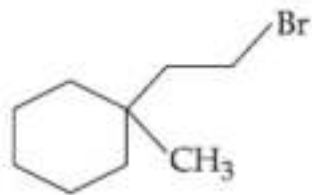
**Correct Marks : 4 Wrong Marks : 1**

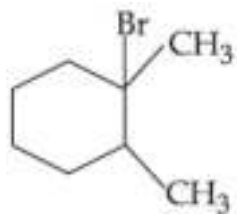


Product "A" in the above chemical reaction is :

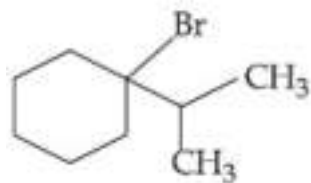
**Options :**

86435110129.

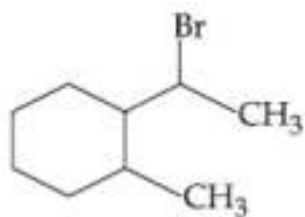




86435110130.



86435110131.



86435110132.

**Question Number : 44 Question Id : 8643513374 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**



The above reaction requires which of the following reaction conditions ?

**Options :**

86435110133. 623 K, Cu, 300 atm

86435110134. 573 K, Cu, 300 atm

86435110135. 623 K, 300 atm

86435110136. 573 K, 300 atm

**Question Number : 45 Question Id : 8643513375 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

Mesityl oxide is a common name of :



**Options :**

86435110137. 4-Methyl pent-3-en-2-one

86435110138. 2,4-Dimethyl pentan-3-one

86435110139. 2-Methyl cyclohexanone

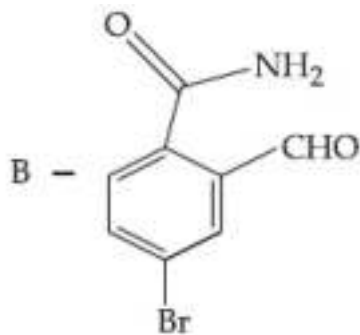
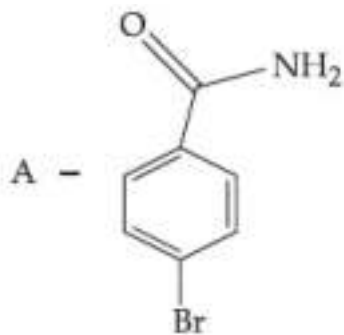
86435110140. 3-Methyl cyclohexane carbaldehyde

**Question Number : 46 Question Id : 8643513376 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

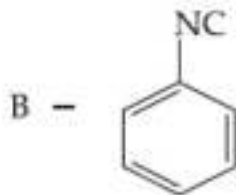
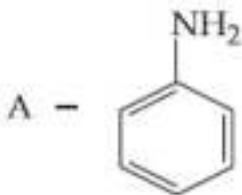
**Correct Marks : 4 Wrong Marks : 1**

Hoffmann bromomide degradation of benzamide gives product A, which upon heating with  $\text{CHCl}_3$  and  $\text{NaOH}$  gives product B.

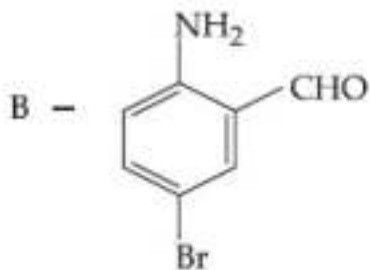
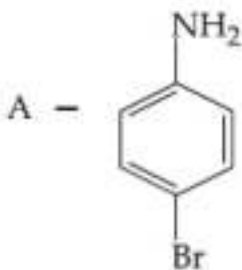
The structures of A and B are :

**Options :**

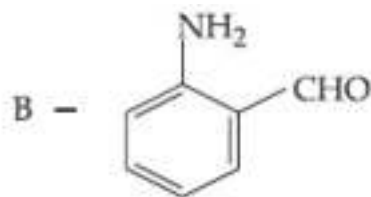
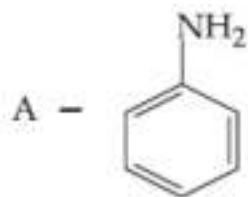
86435110141.



86435110142.



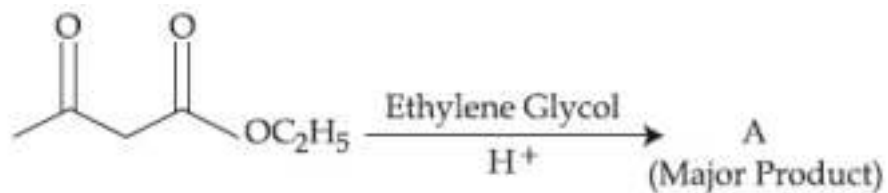
86435110143.



86435110144.

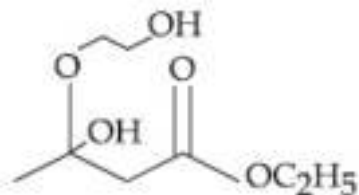
Question Number : 47 Question Id : 8643513377 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

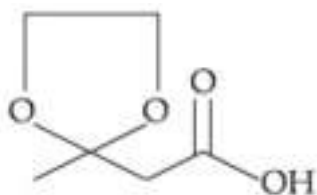


The product "A" in the above reaction is :

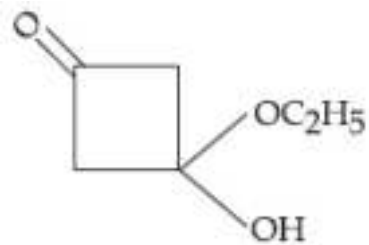
Options :



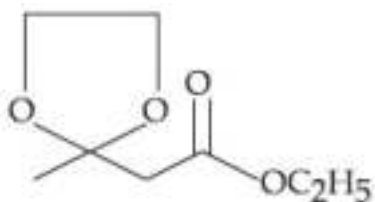
86435110145.



86435110146.



86435110147.



86435110148.

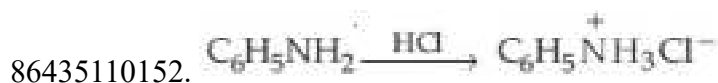
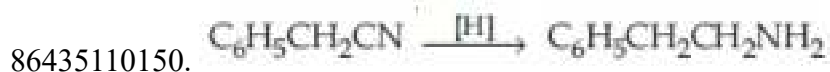
Question Number : 48 Question Id : 8643513378 Question Type : MCQ Option Shuffling : Yes Is

**Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

Which of the following reaction is an example of ammonolysis ?

**Options :**



**Question Number : 49 Question Id : 8643513379 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

With respect to drug-enzyme interaction, identify the wrong statement.

**Options :**

86435110153. Competitive inhibitor binds to the enzyme's active site

86435110154. Allosteric inhibitor changes the enzyme's active site

86435110155. Allosteric inhibitor competes with the enzyme's active site

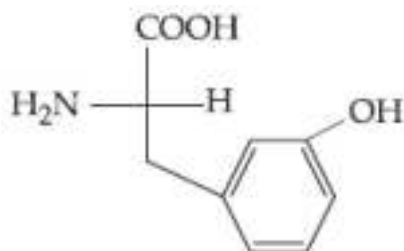
86435110156. Non-Competitive inhibitor binds to the allosteric site

**Question Number : 50 Question Id : 8643513380 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

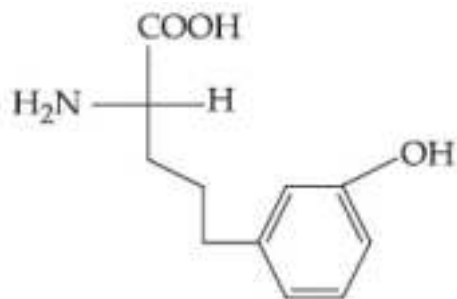
**Correct Marks : 4 Wrong Marks : 1**

Which of the following is correct structure of tyrosine ?

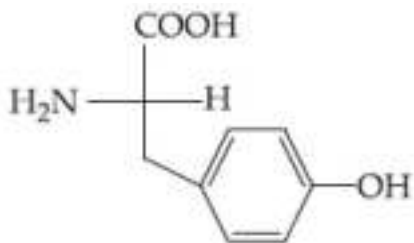
**Options :**



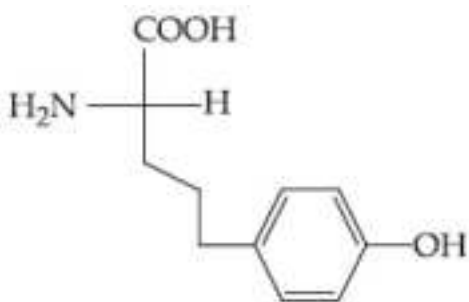
86435110157.



86435110158.



86435110159.



86435110160.

## Chemistry Section B

<b>Section Id :</b>	864351226
<b>Section Number :</b>	4
<b>Section type :</b>	Online
<b>Mandatory or Optional :</b>	Mandatory
<b>Number of Questions :</b>	10
<b>Number of Questions to be attempted :</b>	5
<b>Section Marks :</b>	20
<b>Mark As Answered Required? :</b>	Yes
<b>Sub-Section Number :</b>	1
<b>Sub-Section Id :</b>	864351226
<b>Question Shuffling Allowed :</b>	Yes

**Question Number : 51 Question Id : 8643513381 Question Type : SA**

**Correct Marks : 4 Wrong Marks : 0**

The mole fraction of a solute in a 100 molal aqueous solution is \_\_\_\_\_  $\times 10^{-2}$ .  
(Round off to the Nearest Integer).

[Given : Atomic masses : H : 1.0 u, O : 16.0 u]

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

100

**Question Number : 52 Question Id : 8643513382 Question Type : SA**

**Correct Marks : 4 Wrong Marks : 0**

The pressure exerted by a non-reactive gaseous mixture of 6.4 g of methane and 8.8 g of carbon dioxide in a 10 L vessel at 27°C is \_\_\_\_\_ kPa.

(Round off to the Nearest Integer).

[Assume gases are ideal,  $R = 8.314 \text{ J mol}^{-1} \text{ K}^{-1}$

Atomic masses : C : 12.0 u, H : 1.0 u, O : 16.0 u]

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

100

**Question Number : 53 Question Id : 8643513383 Question Type : SA**

**Correct Marks : 4 Wrong Marks : 0**

A certain orbital has  $n = 4$  and  $m_L = -3$ . The number of radial nodes in this orbital is \_\_\_\_\_ . (Round off to the Nearest Integer).

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

100

**Question Number : 54 Question Id : 8643513384 Question Type : SA**

**Correct Marks : 4 Wrong Marks : 0**

The standard enthalpies of formation of  $\text{Al}_2\text{O}_3$  and  $\text{CaO}$  are  $-1675 \text{ kJ mol}^{-1}$  and  $-635 \text{ kJ mol}^{-1}$  respectively.

For the reaction

$3\text{CaO} + 2\text{Al} \rightarrow 3\text{Ca} + \text{Al}_2\text{O}_3$  the standard reaction enthalpy  $\Delta_r H^\circ = \underline{\hspace{2cm}}$  kJ.

(Round off to the Nearest Integer).

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

100

**Question Number :** 55 **Question Id :** 8643513385 **Question Type :** SA

**Correct Marks :** 4 **Wrong Marks :** 0

The oxygen dissolved in water exerts a partial pressure of 20 kPa in the vapour above water.

The molar solubility of oxygen in water is  $\underline{\hspace{2cm}} \times 10^{-5} \text{ mol dm}^{-3}$ .

(Round off to the Nearest Integer).

[Given : Henry's law constant =  $K_H = 8.0 \times 10^4 \text{ kPa}$  for  $\text{O}_2$ .

Density of water with dissolved oxygen =  $1.0 \text{ kg dm}^{-3}$ ]

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

100

**Question Number :** 56 **Question Id :** 8643513386 **Question Type :** SA

**Correct Marks :** 4 **Wrong Marks :** 0

0.01 moles of a weak acid HA ( $K_a = 2.0 \times 10^{-6}$ ) is dissolved in 1.0 L of 0.1 M HCl solution.

The degree of dissociation of HA is  $\underline{\hspace{2cm}} \times 10^{-5}$  (Round off to the Nearest Integer).

[Neglect volume change on adding HA.

Assume degree of dissociation  $\ll 1$ ]

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

100

**Question Number : 57 Question Id : 8643513387 Question Type : SA****Correct Marks : 4 Wrong Marks : 0**

15 mL of aqueous solution of  $\text{Fe}^{2+}$  in acidic medium completely reacted with 20 mL of 0.03 M aqueous  $\text{Cr}_2\text{O}_7^{2-}$ . The molarity of the  $\text{Fe}^{2+}$  solution is \_\_\_\_\_  $\times 10^{-2}$  M. (Round off to the Nearest Integer).

**Response Type : Numeric****Evaluation Required For SA : Yes****Show Word Count : Yes****Answers Type : Equal****Text Areas : PlainText****Possible Answers :**

100

**Question Number : 58 Question Id : 8643513388 Question Type : SA****Correct Marks : 4 Wrong Marks : 0**

For a certain first order reaction 32% of the reactant is left after 570 s. The rate constant of this reaction is \_\_\_\_\_  $\times 10^{-3} \text{ s}^{-1}$ . (Round off to the Nearest Integer).

[Given :  $\log_{10} 2 = 0.301$ ,  $\ln 10 = 2.303$ ]

**Response Type : Numeric****Evaluation Required For SA : Yes****Show Word Count : Yes****Answers Type : Equal****Text Areas : PlainText****Possible Answers :**

100

**Question Number : 59 Question Id : 8643513389 Question Type : SA****Correct Marks : 4 Wrong Marks : 0**

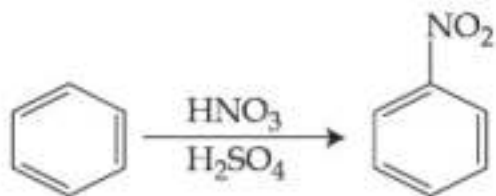
The reaction of white phosphorus on boiling with alkali in inert atmosphere resulted in the formation of product 'A'. The reaction of 1 mol of 'A' with excess of  $\text{AgNO}_3$  in aqueous medium gives \_\_\_\_\_ mol(s) of Ag. (Round off to the Nearest Integer).

**Response Type : Numeric****Evaluation Required For SA : Yes****Show Word Count : Yes****Answers Type : Equal****Text Areas : PlainText****Possible Answers :**

100

Question Number : 60 Question Id : 8643513390 Question Type : SA

Correct Marks : 4 Wrong Marks : 0



In the above reaction, 3.9 g of benzene on nitration gives 4.92 g of nitrobenzene. The percentage yield of nitrobenzene in the above reaction is \_\_\_\_\_%. (Round off to the Nearest Integer).

(Given atomic mass : C : 12.0 u, H : 1.0 u, O : 16.0 u, N : 14.0 u)

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

100

## Mathematics Section A

Section Id :	864351227
Section Number :	5
Section type :	Online
Mandatory or Optional :	Mandatory
Number of Questions :	20
Number of Questions to be attempted :	20
Section Marks :	80
Mark As Answered Required? :	Yes
Sub-Section Number :	1
Sub-Section Id :	864351227
Question Shuffling Allowed :	Yes

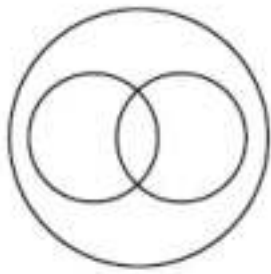
Question Number : 61 Question Id : 8643513391 Question Type : MCQ Option Shuffling : Yes Is

Question Mandatory : No

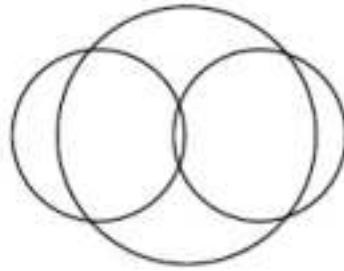
Correct Marks : 4 Wrong Marks : 1



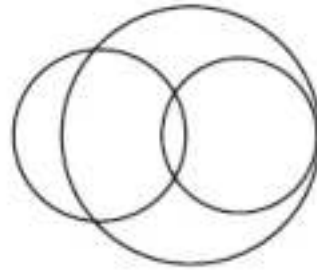
In a school, there are three types of games to be played. Some of the students play two types of games, but none play all the three games. Which Venn diagrams can justify the above statement ?



P



Q



R

Options :

86435110171. P and Q

86435110172. P and R

86435110173. Q and R

86435110174. None of these

Question Number : 62 Question Id : 8643513392 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

The area of the triangle with vertices  $A(z)$ ,  $B(iz)$  and  $C(z + iz)$  is :

Options :

86435110175.  $\frac{1}{2} |z + iz|^2$

86435110176.  $\frac{1}{2} |z|^2$

86435110177.  $\frac{1}{2}$

86435110178. 1

Question Number : 63 Question Id : 8643513393 Question Type : MCQ Option Shuffling : Yes Is

**Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

If  $A = \begin{pmatrix} 0 & \sin\alpha \\ \sin\alpha & 0 \end{pmatrix}$  and  $\det\left(A^2 - \frac{1}{2}I\right) = 0$ , then a possible value of  $\alpha$  is :

**Options :**

86435110179.  $\frac{\pi}{4}$

86435110180.  $\frac{\pi}{3}$

86435110181.  $\frac{\pi}{6}$

86435110182.  $\frac{\pi}{2}$

**Question Number : 64 Question Id : 8643513394 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

The system of equations  $kx + y + z = 1$ ,  $x + ky + z = k$  and  $x + y + zk = k^2$  has no solution if  $k$  is equal to :

**Options :**

86435110183. 0

86435110184. 1

86435110185. -1

86435110186. -2

**Question Number : 65 Question Id : 8643513395 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

Team 'A' consists of 7 boys and  $n$  girls and Team 'B' has 4 boys and 6 girls. If a total of 52 single matches can be arranged between these two teams when a boy plays against a boy and a girl plays against a girl, then  $n$  is equal to :

**Options :**86435110187. <sup>2</sup>86435110188. <sup>4</sup>86435110189. <sup>5</sup>86435110190. <sup>6</sup>

**Question Number : 66 Question Id : 8643513396 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

If the fourth term in the expansion of  $(x + x^{\log_2 x})^7$  is 4480, then the value of  $x$  where  $x \in \mathbf{N}$  is equal to :

**Options :**86435110191. <sup>1</sup>86435110192. <sup>2</sup>86435110193. <sup>3</sup>86435110194. <sup>4</sup>

**Question Number : 67 Question Id : 8643513397 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

The value of  $4 + \frac{1}{5 + \frac{1}{4 + \frac{1}{5 + \frac{1}{4 + \dots \infty}}}}$  is :

**Options :**86435110195.  $2 + \frac{2}{5}\sqrt{30}$ 86435110196.  $2 + \frac{4}{\sqrt{5}}\sqrt{30}$

86435110197.  $5 + \frac{2}{5}\sqrt{30}$

86435110198.  $4 + \frac{4}{\sqrt{5}}\sqrt{30}$

**Question Number : 68 Question Id : 8643513398 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

If  $\cot^{-1}(\alpha) = \cot^{-1}2 + \cot^{-1}8 + \cot^{-1}18 + \cot^{-1}32 + \dots$  upto 100 terms, then  $\alpha$  is :

**Options :**

86435110199. 1.00

86435110200. 1.01

86435110201. 1.02

86435110202. 1.03

**Question Number : 69 Question Id : 8643513399 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

The inverse of  $y = 5^{\log x}$  is :

**Options :**

86435110203.  $x = 5^{\frac{1}{\log y}}$

86435110204.  $x = y^{\frac{1}{\log 5}}$

86435110205.  $x = 5^{\log y}$

86435110206.  $x = y^{\log 5}$

**Question Number : 70 Question Id : 8643513400 Question Type : MCQ Option Shuffling : Yes Is**

**Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

The value of  $\lim_{x \rightarrow 0^+} \frac{\cos^{-1}(x - [x]^2) \cdot \sin^{-1}(x - [x]^2)}{x - x^3}$ , where  $[x]$  denotes the greatest integer  $\leq x$  is :

**Options :**

86435110207.  $\frac{\pi}{4}$

86435110208.  $0$

86435110209.  $\frac{\pi}{2}$

86435110210.  $\pi$

**Question Number : 71 Question Id : 8643513401 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

Which of the following statements is incorrect for the function  $g(\alpha)$  for  $\alpha \in \mathbb{R}$  such that

$$g(\alpha) = \int_{\frac{\pi}{2}}^{\frac{\pi}{4}} \frac{\sin^\alpha x}{\cos^\alpha x + \sin^\alpha x} dx$$

**Options :**

86435110211.  $g(\alpha)$  is a strictly increasing function

86435110212.  $g(\alpha)$  is a strictly decreasing function

86435110213.  $g(\alpha)$  has an inflection point at  $\alpha = -\frac{1}{2}$

86435110214.  $g(\alpha)$  is an even function

**Question Number : 72 Question Id : 8643513402 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

Which of the following is true for  $y(x)$  that satisfies the differential equation

$$\frac{dy}{dx} = xy - 1 + x - y; y(0) = 0 :$$

**Options :**

86435110215.  $y(1) = e^{-\frac{1}{2}} - 1$

86435110216.  $y(1) = e^{\frac{1}{2}} - 1$

86435110217.  $y(1) = e^{\frac{1}{2}} - e^{-\frac{1}{2}}$

86435110218.  $y(1) = 1$

**Question Number : 73 Question Id : 8643513403 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

In a triangle PQR, the co-ordinates of the points P and Q are  $(-2, 4)$  and  $(4, -2)$  respectively. If the equation of the perpendicular bisector of PR is  $2x - y + 2 = 0$ , then the centre of the circumcircle of the  $\Delta PQR$  is :

**Options :**

86435110219.  $(1, 4)$

86435110220.  $(0, 2)$

86435110221.  $(-1, 0)$

86435110222.  $(-2, -2)$

**Question Number : 74 Question Id : 8643513404 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

The line  $2x - y + 1 = 0$  is a tangent to the circle at the point  $(2, 5)$  and the centre of the circle lies on  $x - 2y = 4$ . Then, the radius of the circle is :

**Options :**

86435110223.  $5\sqrt{3}$

86435110224.  $5\sqrt{4}$

86435110225.  $4\sqrt{5}$

86435110226.  $3\sqrt{5}$

**Question Number : 75 Question Id : 8643513405 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

Choose the incorrect statement about the two circles whose equations are given below :

$$x^2 + y^2 - 10x - 10y + 41 = 0 \text{ and}$$

$$x^2 + y^2 - 16x - 10y + 80 = 0$$

**Options :**

86435110227. Circles have two intersection points.

86435110228. Both circles pass through the centre of each other.

86435110229. Both circles' centres lie inside region of one another.

86435110230. Distance between two centres is the average of radii of both the circles.

**Question Number : 76 Question Id : 8643513406 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

The equation of the plane which contains the  $y$ -axis and passes through the point  $(1, 2, 3)$  is :

**Options :**

86435110231.  $3x + z = 6$

86435110232.  $x + 3z = 10$

86435110233.  $x + 3z = 0$

86435110234.  $3x - z = 0$

**Question Number : 77 Question Id : 8643513407 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

If the Boolean expression  $(p \Rightarrow q) \Leftrightarrow (q * (\sim p))$  is a tautology, then the Boolean expression  $p * (\sim q)$  is equivalent to :

**Options :**

86435110235.  $P \Rightarrow Q$

86435110236.  $P \Rightarrow \sim Q$

86435110237.  $Q \Rightarrow P$

86435110238.  $\sim Q \Rightarrow P$

**Question Number : 78 Question Id : 8643513408 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**

Let  $\vec{a} = 2\hat{i} - 3\hat{j} + 4\hat{k}$  and  $\vec{b} = 7\hat{i} + \hat{j} - 6\hat{k}$ .

If  $\vec{r} \times \vec{a} = \vec{r} \times \vec{b}$ ,  $\vec{r} \cdot (\hat{i} + 2\hat{j} + \hat{k}) = -3$ , then  $\vec{r} \cdot (2\hat{i} - 3\hat{j} + \hat{k})$  is equal to :

**Options :**

86435110239.  $8$

86435110240.  $10$

86435110241.  $12$

86435110242.  $13$

**Question Number : 79 Question Id : 8643513409 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No**

**Correct Marks : 4 Wrong Marks : 1**



Two dices are rolled. If both dices have six faces numbered 1, 2, 3, 5, 7 and 11, then the probability that the sum of the numbers on the top faces is less than or equal to 8 is :

Options :

86435110243.  $\frac{5}{12}$

86435110244.  $\frac{4}{9}$

86435110245.  $\frac{17}{36}$

86435110246.  $\frac{1}{2}$

Question Number : 80 Question Id : 8643513410 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No

Correct Marks : 4 Wrong Marks : 1

The sum of possible values of  $x$  for  $\tan^{-1}(x + 1) + \cot^{-1}\left(\frac{1}{x - 1}\right) = \tan^{-1}\left(\frac{8}{31}\right)$  is :

Options :

86435110247.  $-\frac{33}{4}$

86435110248.  $-\frac{32}{4}$

86435110249.  $-\frac{31}{4}$

86435110250.  $-\frac{30}{4}$

## Mathematics Section B

Section Id : 864351228  
 Section Number : 6  
 Section type : Online

<b>Mandatory or Optional :</b>	Mandatory
<b>Number of Questions :</b>	10
<b>Number of Questions to be attempted :</b>	5
<b>Section Marks :</b>	20
<b>Mark As Answered Required? :</b>	Yes
<b>Sub-Section Number :</b>	1
<b>Sub-Section Id :</b>	864351228
<b>Question Shuffling Allowed :</b>	Yes

**Question Number : 81 Question Id : 8643513411 Question Type : SA**

**Correct Marks : 4 Wrong Marks : 0**

The maximum value of  $z$  in the following equation  $z = 6xy + y^2$ , where  $3x + 4y \leq 100$  and  $4x + 3y \leq 75$  for  $x \geq 0$  and  $y \geq 0$  is \_\_\_\_\_.

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

100

**Question Number : 82 Question Id : 8643513412 Question Type : SA**

**Correct Marks : 4 Wrong Marks : 0**

If  $A = \begin{bmatrix} 2 & 3 \\ 0 & -1 \end{bmatrix}$ , then the value of  $\det(A^4) + \det(A^{10} - (\text{Adj}(2A))^{10})$  is equal to \_\_\_\_\_.

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

100

**Question Number : 83 Question Id : 8643513413 Question Type : SA**

**Correct Marks : 4 Wrong Marks : 0**

If  $(2021)^{3762}$  is divided by 17, then the remainder is \_\_\_\_\_.

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

100

**Question Number : 84 Question Id : 8643513414 Question Type : SA****Correct Marks : 4 Wrong Marks : 0**

If the function  $f(x) = \frac{\cos(\sin x) - \cos x}{x^4}$  is continuous at each point in its domain and

$$f(0) = \frac{1}{k}, \text{ then } k \text{ is } \underline{\hspace{2cm}}.$$

**Response Type : Numeric****Evaluation Required For SA : Yes****Show Word Count : Yes****Answers Type : Equal****Text Areas : PlainText****Possible Answers :**

100

**Question Number : 85 Question Id : 8643513415 Question Type : SA****Correct Marks : 4 Wrong Marks : 0**

If  $[ \cdot ]$  represents the greatest integer function, then the value of

$$\left| \int_0^{\sqrt{\frac{\pi}{2}}} \left[ [x^2] - \cos x \right] dx \right| \text{ is } \underline{\hspace{2cm}}.$$

**Response Type : Numeric****Evaluation Required For SA : Yes****Show Word Count : Yes****Answers Type : Equal****Text Areas : PlainText****Possible Answers :**

100

**Question Number : 86 Question Id : 8643513416 Question Type : SA****Correct Marks : 4 Wrong Marks : 0**

The minimum distance between any two points  $P_1$  and  $P_2$  while considering point  $P_1$  on one circle and point  $P_2$  on the other circle for the given circles' equations

$$x^2 + y^2 - 10x - 10y + 41 = 0$$

$$x^2 + y^2 - 24x - 10y + 160 = 0 \text{ is } \underline{\hspace{2cm}}.$$

**Response Type : Numeric**

**Evaluation Required For SA : Yes**

**Show Word Count : Yes**

**Answers Type : Equal**

**Text Areas : PlainText**

**Possible Answers :**

100

**Question Number : 87 Question Id : 8643513417 Question Type : SA**

**Correct Marks : 4 Wrong Marks : 0**

If the equation of the plane passing through the line of intersection of the planes  $2x - 7y + 4z - 3 = 0$ ,  $3x - 5y + 4z + 11 = 0$  and the point  $(-2, 1, 3)$  is  $ax + by + cz - 7 = 0$ , then the value of  $2a + b + c - 7$  is \_\_\_\_\_.

**Response Type : Numeric**

**Evaluation Required For SA : Yes**

**Show Word Count : Yes**

**Answers Type : Equal**

**Text Areas : PlainText**

**Possible Answers :**

100

**Question Number : 88 Question Id : 8643513418 Question Type : SA**

**Correct Marks : 4 Wrong Marks : 0**

Let there be three independent events  $E_1$ ,  $E_2$  and  $E_3$ . The probability that only  $E_1$  occurs is  $\alpha$ , only  $E_2$  occurs is  $\beta$  and only  $E_3$  occurs is  $\gamma$ . Let 'p' denote the probability of none of events occurs that satisfies the equations  $(\alpha - 2\beta)p = \alpha\beta$  and  $(\beta - 3\gamma)p = 2\beta\gamma$ . All the given probabilities are assumed to lie in the interval  $(0, 1)$ .

Then,  $\frac{\text{Probability of occurrence of } E_1}{\text{Probability of occurrence of } E_3}$  is equal to \_\_\_\_\_.

**Response Type : Numeric**

**Evaluation Required For SA : Yes**

**Show Word Count : Yes**

**Answers Type : Equal**

**Text Areas : PlainText**

**Possible Answers :**

100

**Question Number : 89 Question Id : 8643513419 Question Type : SA**

**Correct Marks : 4 Wrong Marks : 0**

If  $f(x) = \sin\left(\cos^{-1}\left(\frac{1-2^{2x}}{1+2^{2x}}\right)\right)$  and its first derivative with respect to  $x$  is  $-\frac{b}{a}\log_e 2$  when  $x=1$ , where  $a$  and  $b$  are integers, then the minimum value of  $|a^2 - b^2|$  is \_\_\_\_\_.

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

100

**Question Number :** 90 **Question Id :** 8643513420 **Question Type :** SA

**Correct Marks :** 4 **Wrong Marks :** 0

$$\text{If } \vec{a} = \alpha \hat{i} + \beta \hat{j} + 3\hat{k},$$

$$\vec{b} = -\beta \hat{i} - \alpha \hat{j} - \hat{k} \text{ and}$$

$$\vec{c} = \hat{i} - 2\hat{j} - \hat{k}$$

such that  $\vec{a} \cdot \vec{b} = 1$  and  $\vec{b} \cdot \vec{c} = -3$ , then  $\frac{1}{3}((\vec{a} \times \vec{b}) \cdot \vec{c})$  is equal to \_\_\_\_\_.

**Response Type :** Numeric

**Evaluation Required For SA :** Yes

**Show Word Count :** Yes

**Answers Type :** Equal

**Text Areas :** PlainText

**Possible Answers :**

100