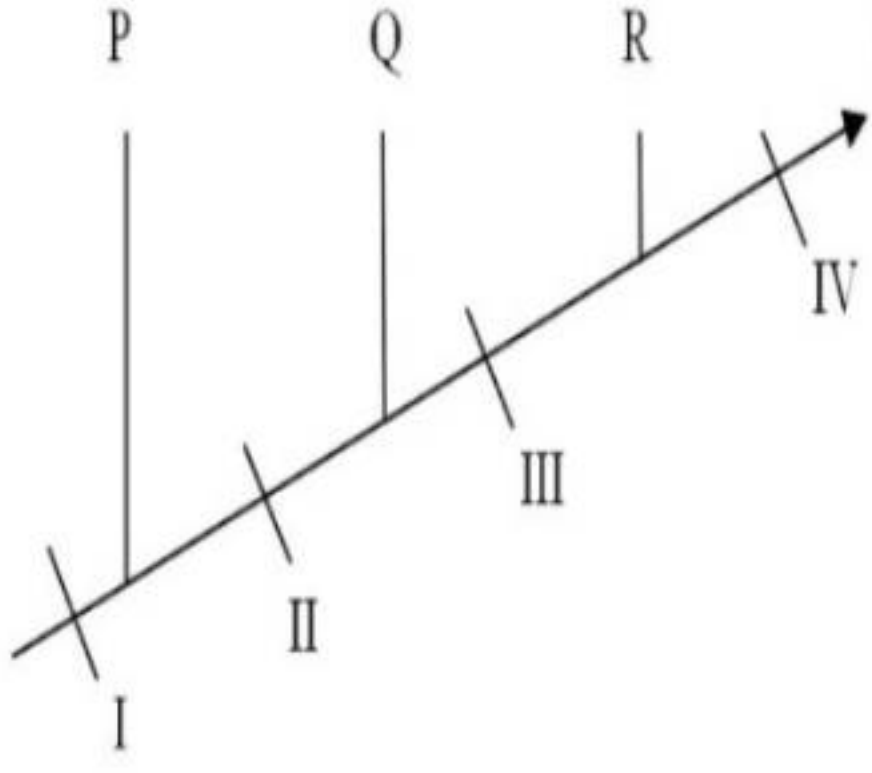
Biology

Question Number : 1 Question Id : 4146641135 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

A cladogram representing the evolution of some animals (P, Q, R and S) is shown.
I to IV in the cladogram represent different features that have evolved.



The correct statement with respect to the given cladogram is

Options :

If **Q** is a bullfrog, **II** could be placenta.

4146644465. ✖

If features **III** and **IV** are mammary glands and hair, respectively, then **R** represents kangaroo and **S** represents humans.

4146644466. ✖

If **Q**, **R** and **S** represent bullfrog, koala and human, respectively, then feature **II** could be two pairs of limbs.

4146644467. ✔

If feature **I** is lungs, then **P** and **Q** are shark and bullfrog respectively.

4146644468. ✖

Question Number : 2 Question Id : 4146641136 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

A 1000 base pair double-stranded DNA (B form) has a melting temperature (T_m) of 58°C. If a duplex RNA (A form) of the same length and sequence is constructed, then the T_m of this new RNA duplex with respect to the DNA (B form) would be

Options :

higher due to greater stability of A form of RNA duplex.

4146644469. ✔

lower due to lower stability of A form of RNA duplex.

4146644470. ✖

lower because of unfavourable enthalpy of formation of RNA duplex.

4146644471. ✖

4146644472. ✖ identical, as the number of hydrogen bonds remain the same.

Question Number : 3 Question Id : 4146641137 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

A biochemist wants to purify a protein X (molecular weight = 30.2 kDa and pI = 7.5) from a solution containing proteins X and Y (molecular weight = 30.9 kDa and pI = 3.5) using ion exchange chromatography. In this technique, an anion exchange resin is positively charged and a cation exchange resin is negatively charged. The most appropriate resin where protein X, but not Y will remain bound is

Options :

4146644473. ✖ cation exchanger at pH = 7.5.

4146644474. ✖ anion exchanger at pH = 2.5.

4146644475. ✔ cation exchanger at pH = 5.0.

4146644476. ✖ anion exchanger at pH = 7.5.

Question Number : 4 Question Id : 4146641138 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

Bacterial endospores are highly resistant to environmental stressors such as heat, UV radiation, and oxidizing agents. They can remain dormant for a prolonged period. During the period of dormancy, they prevent the accumulation of potentially harmful mutations in their DNA. This is primarily due to

Options :

4146644477. ✔ decreased water content and reduced enzyme activity.

4146644478. ✖ decreased salt concentration and enhanced enzyme activity.

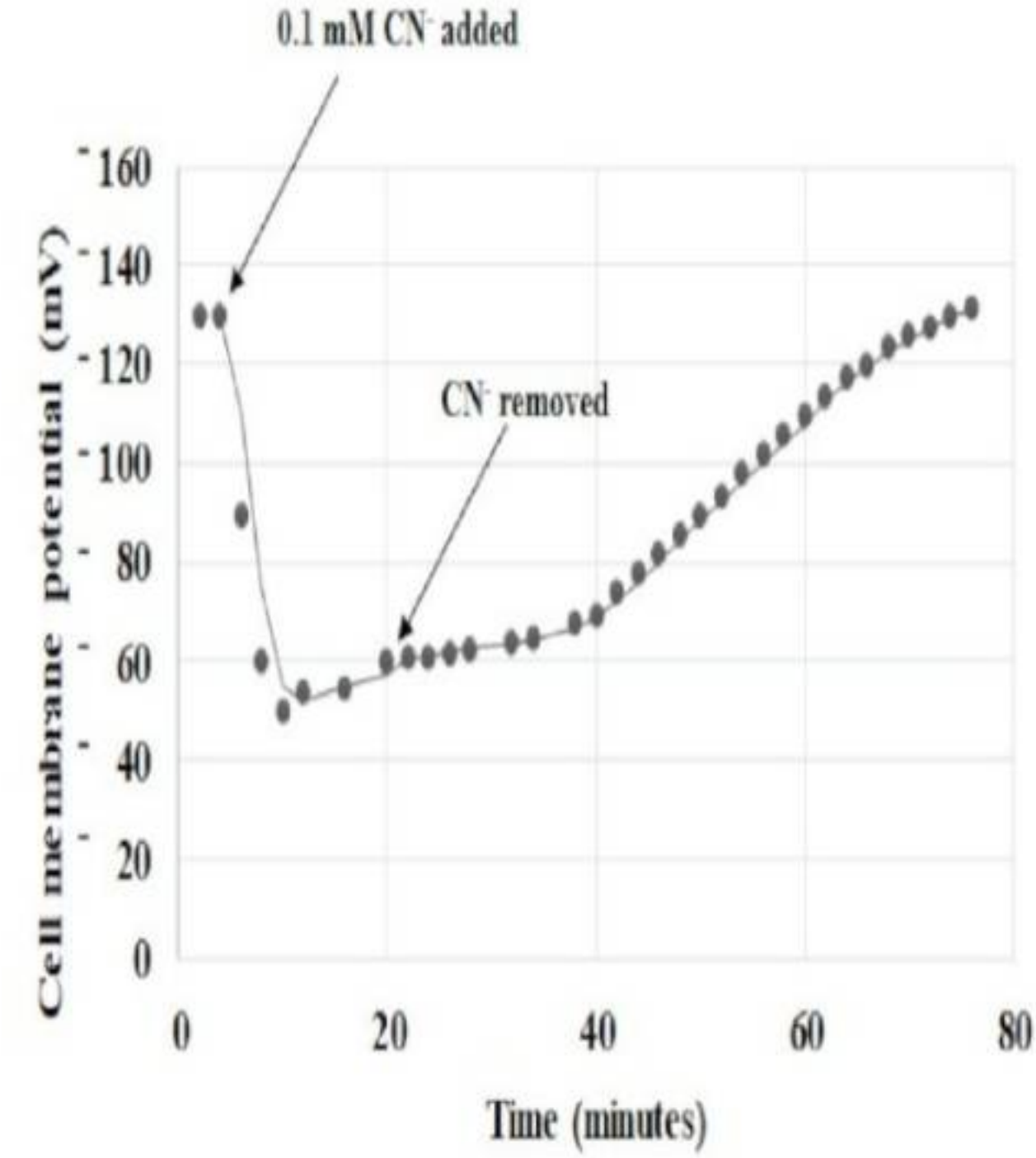
4146644479. ✖ decreased respiration and decreased DNA supercoiling.

4146644480. ✖ increased enzyme activity and increased membrane permeability.

Question Number : 5 Question Id : 4146641139 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

Pea seeds were allowed to germinate for 4 days and segments of the epicotyl around 1 cm were cut and placed in a nutrient solution having pH 7.0. These epicotyls were then treated with cyanide (CN^-) at a concentration of 0.1 mM and the membrane potential was recorded. Cyanide was washed out and the membrane potential was further recorded up to 78 minutes. A graph of cell membrane potential (mV) against time (minutes) was plotted as shown below.



Based on these experimental observations, the correct option is

Options :

4146644481. ✔ addition of cyanide will decrease the membrane potential because of the depletion of ATP.

4146644482. ✖ addition of cyanide will decrease the pH of the intermembrane space.

addition of excess oxygen will increase the membrane potential in presence of cyanide.

4146644483. ✖

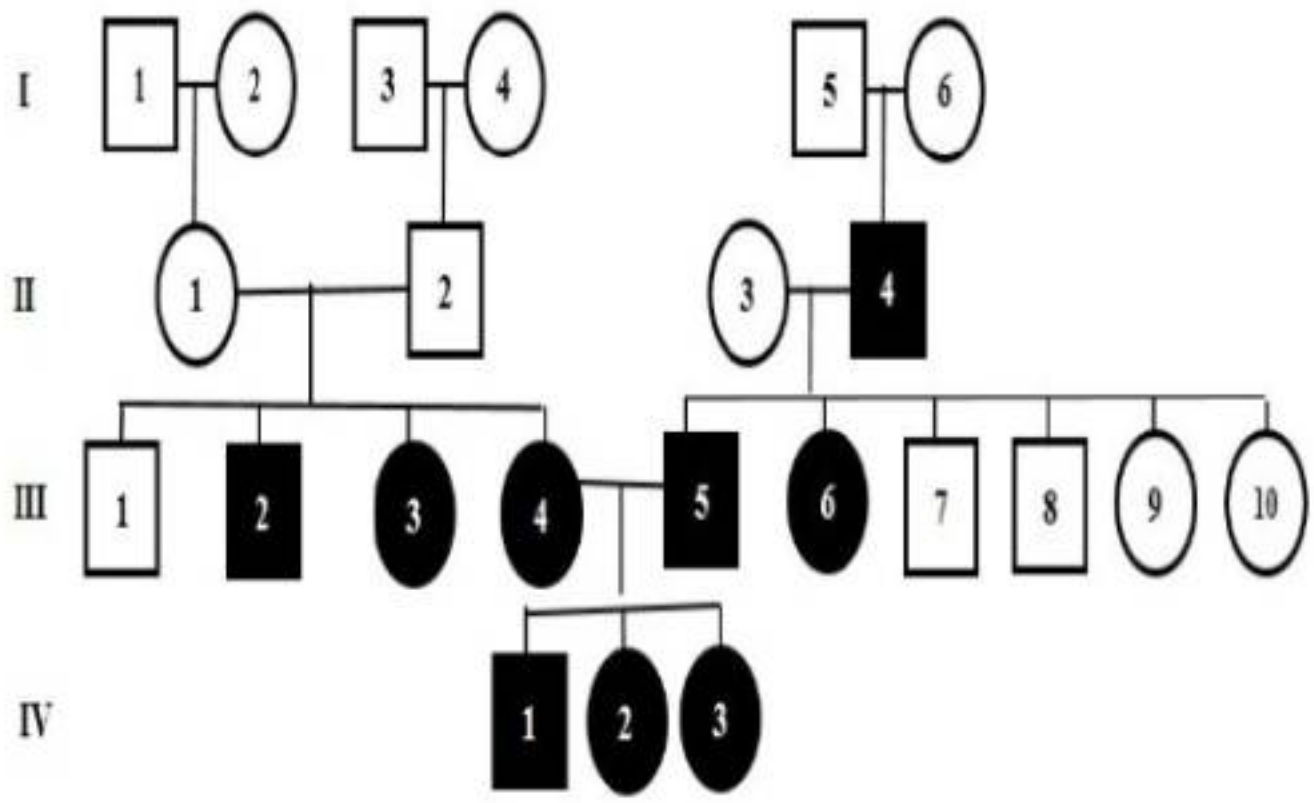
addition of cyanide will cause a rapid but irreversible depolarization of membrane potential.

4146644484. ✖

Question Number : 6 Question Id : 4146641140 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

In the given pedigree, circles represent females and squares represent males. Filled shapes indicate affected individuals while unfilled shapes indicate unaffected individuals. Based on the pedigree information provided, the correct inheritance pattern is



Options :

autosomal dominant.

4146644485. ✖

4146644486. ✔ autosomal recessive.

4146644487. ✖ X-linked dominant.

4146644488. ✖ X-linked recessive.

Question Number : 7 Question Id : 4146641141 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

A population has a single locus with three alleles (X1, X2, and X3). The frequencies of these alleles are p, q and r, respectively, and if $p + q + r = 1$, then the correct statement is

Options :

4146644489. ✖ the population is in Hardy-Weinberg equilibrium.

4146644490. ✖ the population is not in Hardy-Weinberg equilibrium because it has three alleles.

4146644491. ✔ this information is insufficient to state whether the population is in Hardy-Weinberg equilibrium.

4146644492. ✖ the population will be in Hardy-Weinberg equilibrium if $r = 0$ and $p + q = 1$.

Question Number : 8 Question Id : 4146641142 Question Type : MCQ Option Shuffling : Yes Is

Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

Mendelian theory of inheritance was crucial for Darwin-Wallace's theory of natural selection because

Options :

4146644493. ✔ it explained how new variations will persist in a population over time despite their low frequency, which is essential for natural selection.

4146644494. ✖ the Mendelian theory explained how characters acquired over an organism's lifetime can be passed on to the next generation, which is essential for natural selection to operate.

4146644495. ✖ the Mendelian theory explained how variation appears in the biological system which is crucial for evolution by the process of natural selection.

4146644496. ✖ the Mendelian theory first explained that linkage is essential for natural selection.

Question Number : 9 Question Id : 4146641143 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

In a closed ecosystem, red algae, crabs and green algae are present and interact with each other. In order to understand the interactions between them, the following experimental treatments were imposed

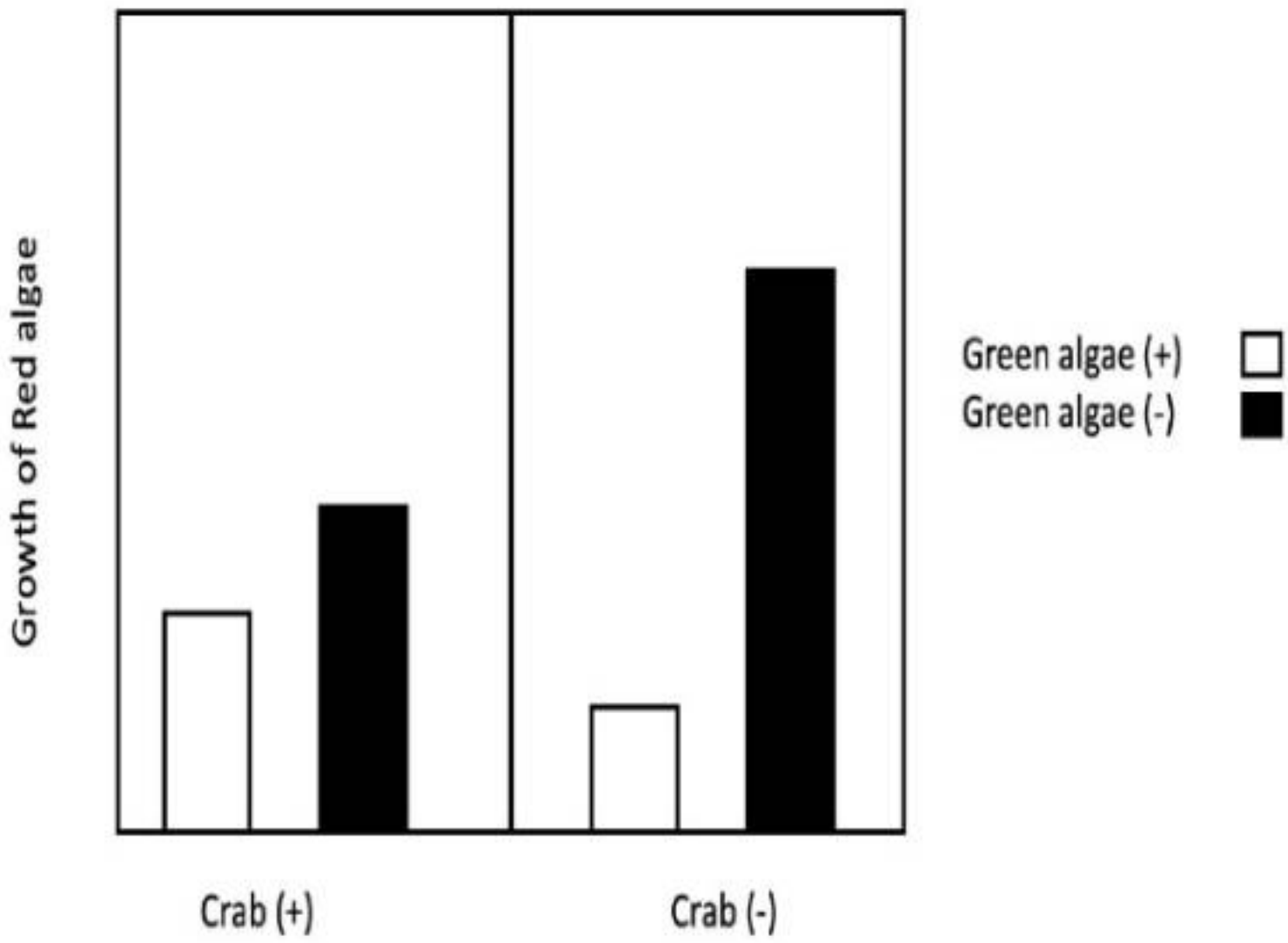
i. All crabs removed

ii. All green algae removed

iii. All crabs and green algae removed

iv. All crabs, red and green algae are retained (Control)

The results of red algae growth from these experiments are shown in the graph. Plus (+) indicates presence and minus (-) indicates absence in this closed ecosystem. Red algae growth in all the treatments was significantly different from each other.



Based on these results, the correct option is

Options :

4146644497. ✖ in the absence of crabs, green algae positively affected red algae growth.

4146644498. ✖ in the presence of crabs, green algae positively affected red algae growth.

4146644499. ✔ in the absence of green algae, crabs negatively affected red algae growth.

4146644500. ✖ in the presence of green algae, crabs negatively affected red algae growth.

Question Number : 10 Question Id : 4146641144 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

Synthesis of ATP takes place when protons flow back to the matrix side through an enzyme complex called ATP synthase. ATP synthase is made up of two operational units: a rotatory and a stationary component. Assume that the ATP synthase does $\sim$ 100 rotations per second, and each rotation results in the generation of 3 ATP molecules. Suppose that a cell needs $\sim 3 \times 10^{10}$ molecules of ATP for one round of cell division that takes 30 minutes with the ATP synthase functioning at 50% efficiency. The minimum number of ATP synthase required for one round of cell division in this cell is

Options :

4146644501. ✖ 222222

4146644502. ✖ 55555.5

4146644503. ✔ 111111

4146644504. ✖ 277777

Question Number : 11 Question Id : 4146641145 Question Type : MCQ Option Shuffling : Yes Is

Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

The permeability of molecules across a lipid bilayer depends on their size and solubility in a nonpolar solvent relative to their solubility in water. For the species O_2, H_2O, K^+, glycerol and glucose, the order of their permeability across a lipid bilayer in the absence of any protein transporters is

Options :

4146644505. ✔ $O_2 > H_2O > \text{Glycerol} > \text{Glucose} > K^+$

4146644506. ✖ $H_2O > O_2 > \text{Glycerol} > \text{Glucose} > K^+$

4146644507. ✖ $O_2 > H_2O > \text{Glucose} > \text{Glycerol} > K^+$

4146644508. ✖ $K^+ > O_2 > H_2O > \text{Glycerol} > \text{Glucose}$

Question Number : 12 Question Id : 4146641146 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

A monoclonal (antibody specific for a given epitope of an antigen) IgG antibody (M) was produced in the laboratory that binds to a surface protein (P) of a virus (V1) and neutralizes 100% of V1. It was observed that M is also effective in neutralizing other viruses V2, V3 and V4 at 40%, 90% and 32% efficiency as compared to V1. If there are no other confounding factors, then the most accurate inference is

Options :

4146644509. ✖

V1, **V2**, **V3**, and **V4** have identical surface protein **P**.

4146644510. ✖ the genome of **V1** and **V3** has to be 90% identical for the observed binding efficiency.

4146644511. ✖ the sequence of **P** is more similar in **V2** and **V4** than in **V1** and **V2**.

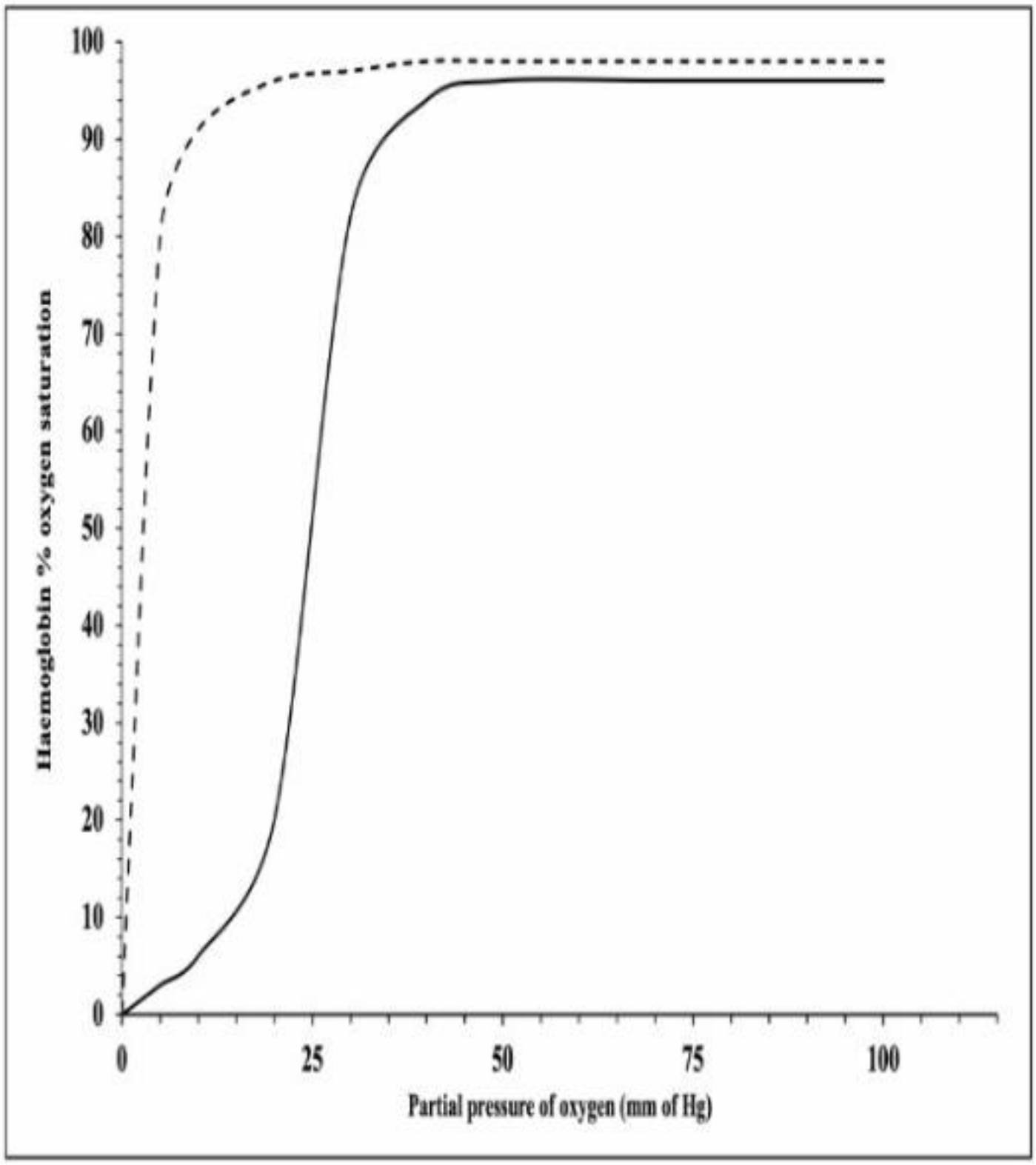
4146644512. ✔ a segment of sequence in **P** is highly conserved in **V1** and **V3** whereas the same segment is less conserved in **V2** and **V4**.

Sub-Section Number :	2
Sub-Section Id :	414664161
Question Shuffling Allowed :	Yes
Is Section Default? :	null

Question Number : 13 Question Id : 4146641147 Question Type : MSQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 4 Wrong Marks : 0 Max. Selectable Options : 0

A genetic engineering experiment resulted in a new haemoglobin variant which exists primarily as $\alpha\beta$ dimers in solution. Based on the oxygen saturation curves of the variant (dashed line) and normal haemoglobin (solid line), it can be inferred that



Options :

4146644513. ✔ the variant has a higher affinity to oxygen and shows non-cooperative behaviour.

4146644514. ✖ the variant has a higher affinity to oxygen and shows cooperative behaviour.

4146644515. ✔ the oxygen dissociation of the variant is less than 10% at 20 mm of Hg.

4146644516. ✖

at sea level ($\sim$ 150 mm of Hg), animals with this variant of haemoglobin can survive better than the ones with normal haemoglobin.

Question Number : 14 Question Id : 4146641148 Question Type : MSQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 4 Wrong Marks : 0 Max. Selectable Options : 0

A hospital witnessed an outbreak of a nosocomial (hospital-acquired) infection caused by *Klebsiella pneumoniae*. It showed resistance to antibiotics generally used for its treatment. Under the given scenario, the antibiotic resistance of this organism can be attributed to

Options :

4146644517. ✔ the presence of antibiotic resistance gene acquired through horizontal transfer from other prevalent strains in the hospital.

4146644518. ✖ silent mutations in target sites of antibiotics.

4146644519. ✔ neutralisation of antibiotics by enzymes that target and inactivate these antibiotics.

4146644520. ✔ reduced permeability of these antibiotics due to the formation of a protective barrier.

Question Number : 15 Question Id : 4146641149 Question Type : MSQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 4 Wrong Marks : 0 Max. Selectable Options : 0

In the **ABC** model, the acquisition of floral organ identity is regulated by the floral homeotic genes namely **A**, **B** and **C**. A wild-type flower is depicted below.

Consider the following mutants

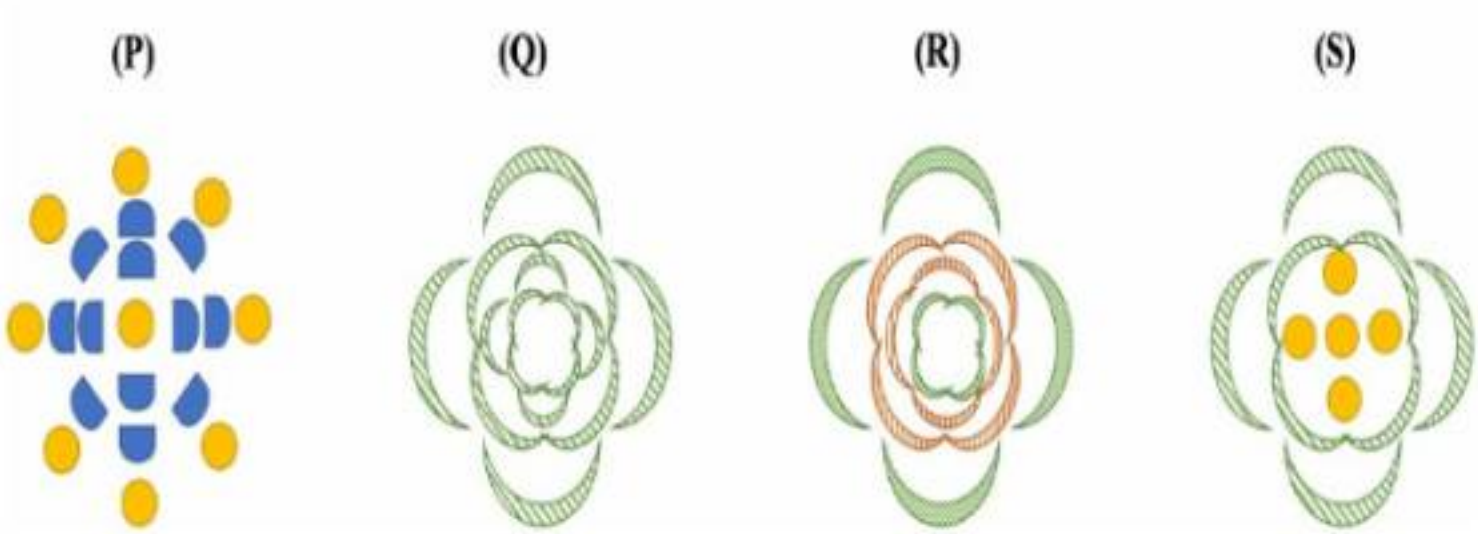
i. loss of gene **C**

ii. loss of gene **A**

iii. loss of gene **B**

iv. loss of genes **B** and **C**

Possible floral phenotypes (**P-S**) resulting from these mutations are given below.



Based on this **ABC** model, the correct option(s) is(are)

Options :

4146644521. ✔ (i) corresponds to **R** and (iv) corresponds to **Q**.

4146644522. ✖ (i) corresponds to **S** and (ii) corresponds to **Q**.

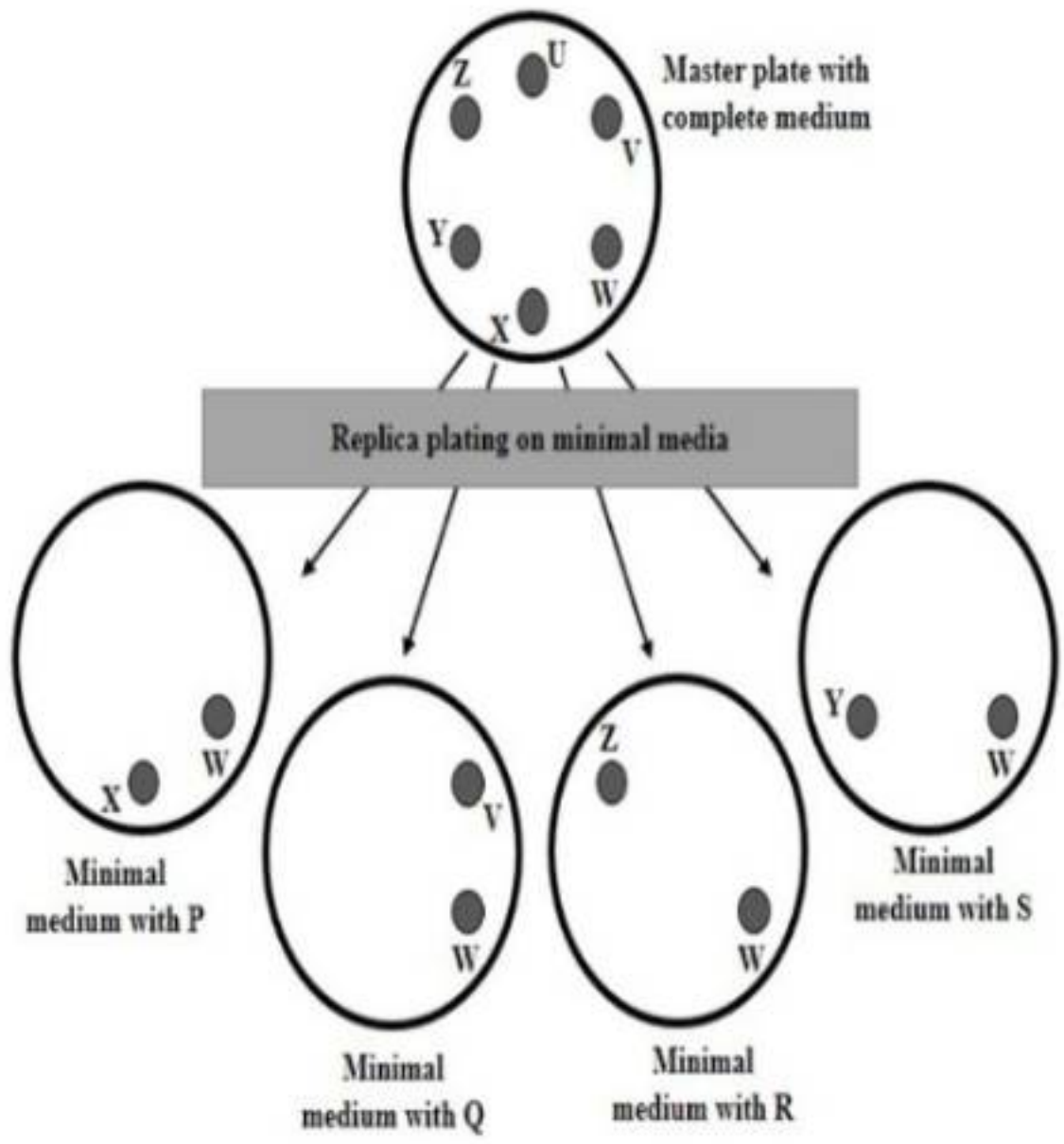
4146644523. ✔ (ii) corresponds to **P** and (iii) corresponds to **S**.

4146644524. ✖ (iii) corresponds to **P** and (iv) corresponds to **R**.

Question Number : 16 Question Id : 4146641150 Question Type : MSQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 4 Wrong Marks : 0 Max. Selectable Options : 0

Auxotrophs are organisms with mutations that have lost the ability to synthesise essential organic compounds, and hence need supplements for growth in minimal media. Prototrophs are organisms that are able to synthesize essential compounds and hence can grow in minimal media without supplements. Colonies from six different strains of *E. coli* (**U**, **V**, **W**, **X**, **Y**, **Z**) are grown separately on a single master plate containing complete medium. No strain carries more than a single auxotrophic mutation. Replica plates are then made from this master plate. Each of this replica plate contains minimal medium to which a single supplement (either **P**, **Q**, **R**, or, **S**) is added. In the diagram below, filled circles represent colonies that grew on the medium and absence denotes failure to grow.



Based on the scheme, the correct interpretation(s) is(are)

Options :

4146644525. ✔ strain **W** is a prototrophic strain and strain **V** is auxotrophic for **Q**.

4146644526. ✔ strain **Z** is auxotrophic for **R** and strain **Y** is auxotrophic for **S**.

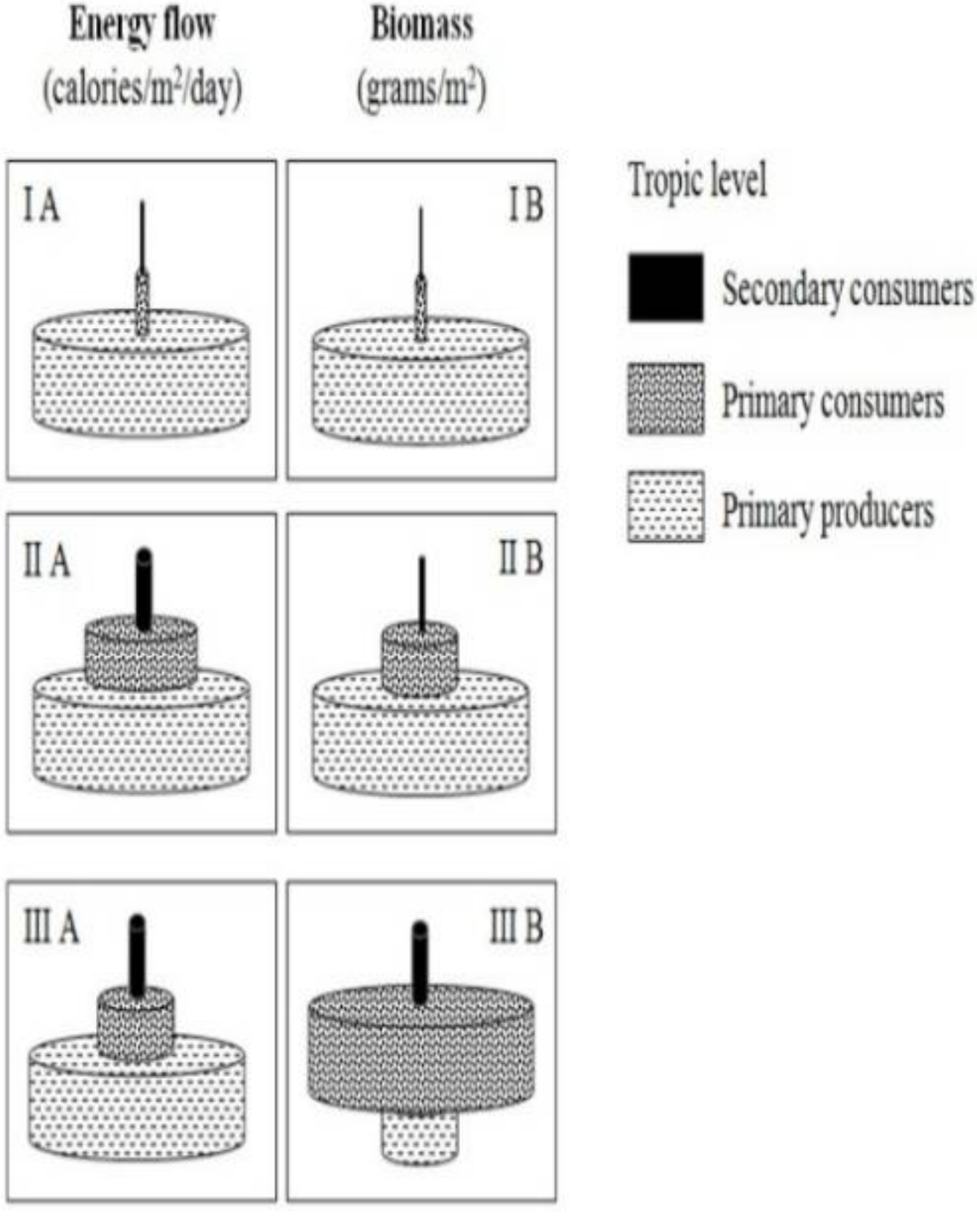
4146644527. ✖ strain U is a prototrophic strain and strain X is auxotrophic for Q.

4146644528. ✖ strain Y is auxotrophic for P and strain Z is auxotrophic for R.

Question Number : 17 Question Id : 4146641151 Question Type : MSQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 4 Wrong Marks : 0 Max. Selectable Options : 0

Energy diagrams allow ecologists to compare patterns of energy flow through the trophic levels of different ecosystems while biomass diagrams allow them to compare the amount of material present in living organisms at different trophic levels. The energy flow and biomass diagrams for a few ecosystems are given below.



Choose the correct statement(s).

Options :

4146644529. ✖

III B cannot be the biomass pyramid of an open ocean since a biomass pyramid cannot be inverted at any level.

4146644530. ✖

I B and II B are the biomass pyramids of a grassland and a forest ecosystem respectively, since most of the biomass in a grassland is found in the green parts and hence the efficiency of energy transfer from producers to primary consumers is higher in grassland as compared to a forest ecosystem.

4146644531. ✔ **III A** could be the energy flow pyramid for an open ocean.

I A could be the energy flow pyramid for a forest ecosystem, since the majority of the biomass is tied up in wood and is not available to most herbivores.

4146644532. ✔

Chemistry

Section Id :	41466479
Section Number :	2 Online
Section type :	Mandatory
Mandatory or Optional :	17 17 50
Number of Questions :	
Number of Questions to be attempted :	
Section Marks :	
Enable Mark as Answered Mark for Review and Clear Response :	Yes
Maximum Instruction Time :	0 1
Sub-Section Number :	414664162
Sub-Section Id :	Yes null
Question Shuffling Allowed :	
Is Section Default? :	

Question Number : 18 Question Id : 4146641152 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

Pyrophosphoric acid ($H_4P_2O_7$) and pyrophosphorous acid ($H_4P_2O_5$) are oxyacids of phosphorous. The number of P–OH bonds present in pyrophosphoric acid and pyrophosphorous acid, respectively, are

Options :

4146644533. ✖ 4, 3

4146644534. ✖ 4, 4

4146644535. ✔ 4, 2

4146644536. ✖ 2, 4

Question Number : 19 Question Id : 4146641153 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

The pair of molecules having the same shape is

Options :

4146644537. ✖ PF_5 and BrF_5

4146644538. ✖ O_3 and I_3^-

4146644539. ✖ BF_3 and ClF_3

4146644540. ✔ XeO_3 and PF_3

Question Number : 20 Question Id : 4146641154 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

Boron on reaction with fluorine forms **P**, which on reaction with NaH at a high temperature produces **Q** along with a sodium salt. **P** on reaction with NH_3 in 1:1 ratio gives **R**. **Q** on reaction with NH_3 in 1:2 ratio at an elevated temperature gives **S**. The correct statement is

Options :

4146644541. ✖ B–N bond in **R** is covalent in nature.

4146644542. ✖ All B–H bonds in **Q** are equivalent.

4146644543. ✖ The shape of **S** is tetrahedral.

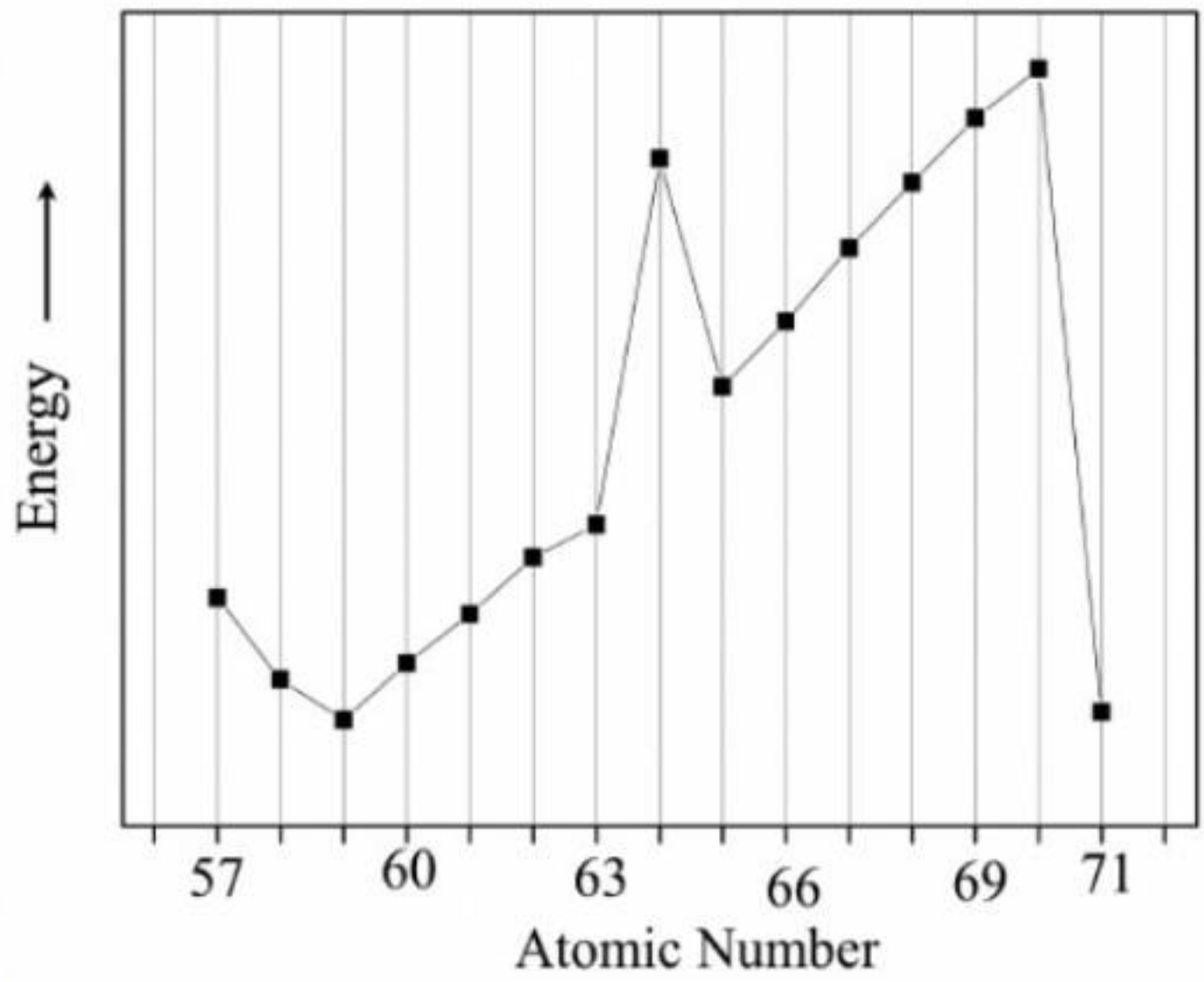
4146644544. ✔ Compound **Q** when dissolved in water gives an acid.

Question Number : 21 Question Id : 4146641155 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

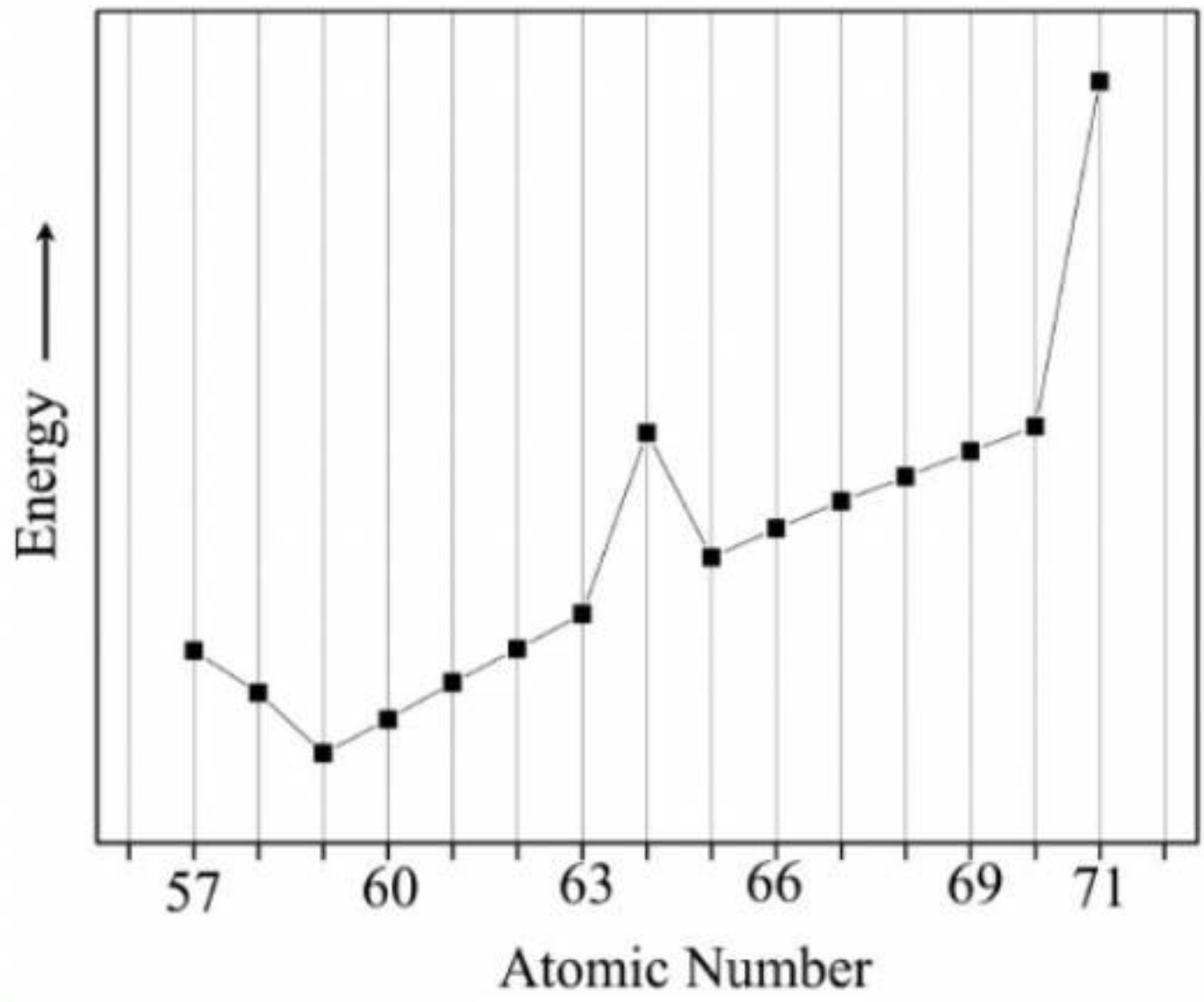
Correct Marks : 2.5 Wrong Marks : 1

Among the following graphs, the one that represents the correct trend in the third ionization energy of lanthanum and the lanthanoids is

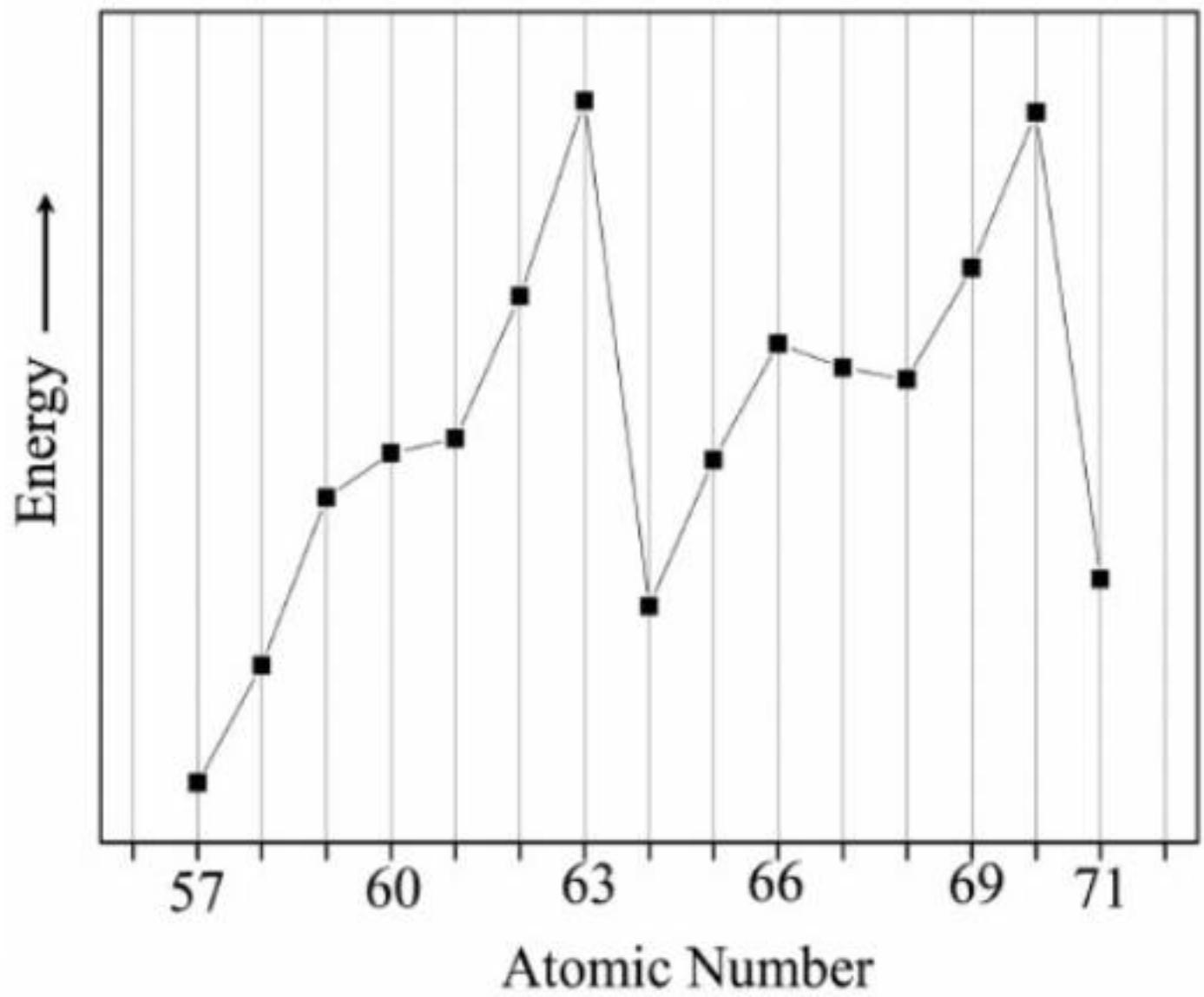
Options :



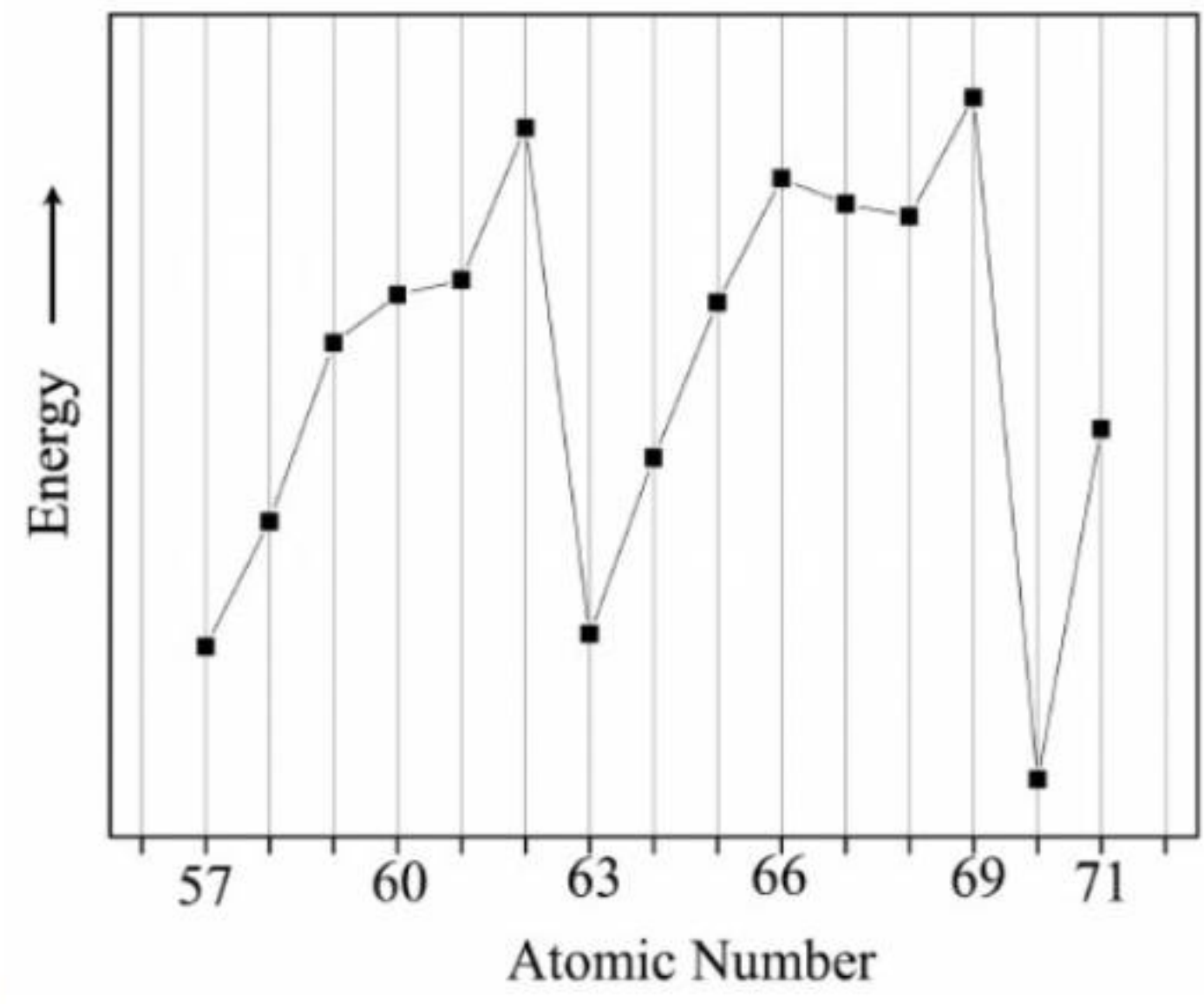
4146644545.



4146644546.



4146644547. ✔



4146644548. ✘

Question Number : 22 Question Id : 4146641156 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum

Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

The ground state electronic energy of He atom (E_{He}) can be expressed in terms of the ground state energy of the hydrogen atom (E_H) and the electron-electron interaction energy (E_{ee}) in the He atom. If E_{ee} is equal to x times the magnitude of E_H, then E_{He} is given by

Options :

4146644549. ✖ $E_{He} = 4E_H + xE_H$

4146644550. ✖ $E_{He} = 2(4E_H + xE_H)$

4146644551. ✔ $E_{He} = 8E_H - xE_H$

4146644552. ✖ $E_{He} = 8E_H + xE_H$

Question Number : 23 Question Id : 4146641157 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

Consider a metal crystal with simple cubic, fcc, and bcc structures. Assume that the nearest neighbour atoms (spheres) touch each other in the unit cells. The correct statement is

Options :

4146644553. ✔ The percentage of the void space in different crystal structures follow the order: fcc < bcc < simple cubic.

The number of atoms in the unit cell are 14, 9 and 8 for fcc, bcc and simple cubic structures, respectively.

4146644554. ✗

The lowest percentage of the void space among the three crystal structures is approximately 48%.

4146644555. ✗

The percentage of the void space in any of the above crystal structures will depend on the lattice parameter and hence cannot be predicted without the knowledge of the lattice parameter.

4146644556. ✗

Question Number : 24 Question Id : 4146641158 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

A certain amount (n moles) of a monoatomic ideal gas changes from an initial state X (P_1, V_1, T_1) to a final state Y (P_2, V_2, T_2). Let $\Delta U, \Delta H$, and ΔS represent the changes in internal energy, enthalpy, and entropy, respectively in this process. The correct expression is

Options :

4146644557. ✗ $\Delta H = \Delta U + P_2(V_2 - V_1).$

4146644558. ✗ $\Delta H = \Delta U + P_2(V_2 - V_1) + V_2(P_2 - P_1)$

4146644559. ✗ $\Delta S = C_v \ln(T_2/T_1) + nR\ln(V_2/V_1)$

4146644560. ✓ $\Delta S = (3/2)(P_1V_1/T_1)\ln(T_2/T_1) + (P_2V_2/T_2)\ln(V_2/V_1)$

Question Number : 25 Question Id : 4146641159 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

A mixture of 0.1 mol of a weak acid HX and 0.2 mol of another weak acid HY is dissolved in 1 kg of water. The degrees of ionization of the two acids HX and HY in the final solution are 0.1 and 0.2, respectively. Assuming Rault's law to be valid, the elevation of boiling point (ΔT_b), in terms of the boiling point elevation constant (K_b), is given by

Options :

4146644561. ✖ $\Delta T_b = 0.25K_b$

4146644562. ✔ $\Delta T_b = 0.35K_b$

4146644563. ✖ $\Delta T_b = 0.30K_b$

4146644564. ✖ $\Delta T_b = 0.32K_b$

Question Number : 26 Question Id : 4146641160 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

When levorotatory 2-methylbutan-1-ol (**P**) is heated with concentrated HCl, dextrorotatory 1-chloro-2-methylbutane (**Q**) is formed. The correct statement is

Options :

4146644565. ✔ **P** and **Q** have identical absolute configuration.

4146644566. ✖ The reaction takes place at the asymmetric centre.

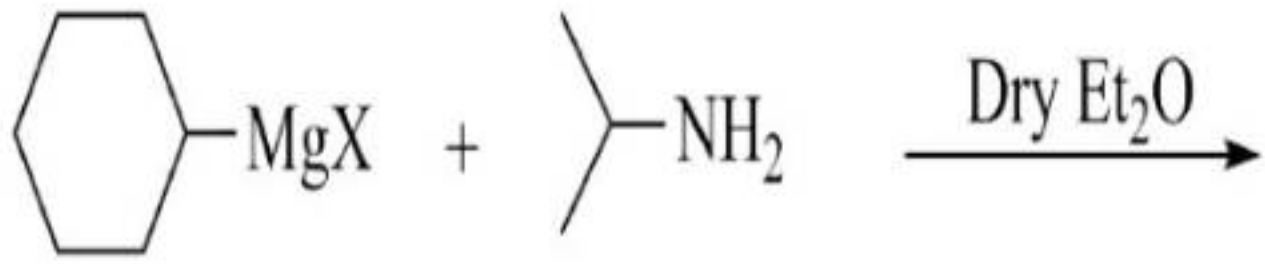
4146644567. ✖ The reaction involves a carbocationic intermediate.

4146644568. ✖ If the concentration of **P** is doubled, keeping the concentration of HCl unchanged, the rate of the reaction does not change.

Question Number : 27 Question Id : 4146641161 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

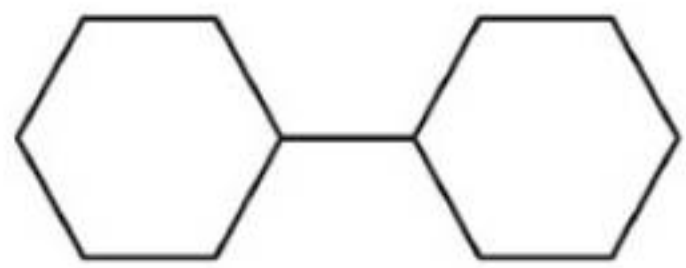
Correct Marks : 2.5 Wrong Marks : 1

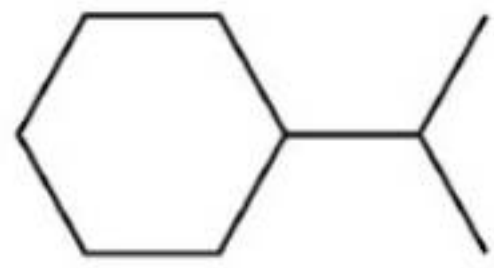
In the reaction shown below,



the major hydrocarbon product is

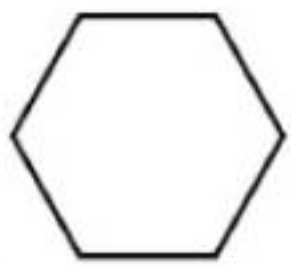
Options :

4146644569. ✖ 

4146644570. ✖ 

4146644571. ✖

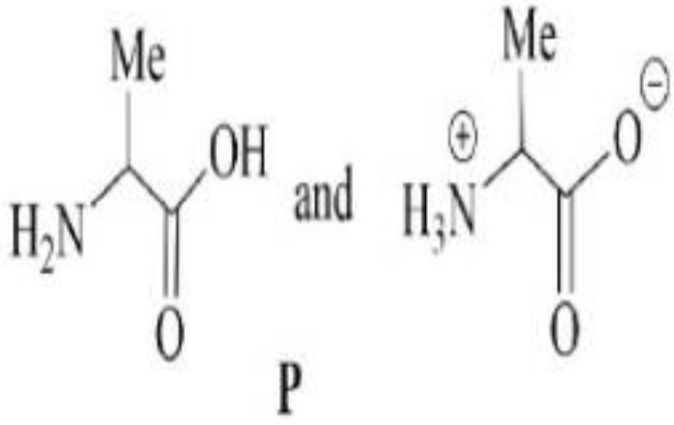
4146644572. ✔



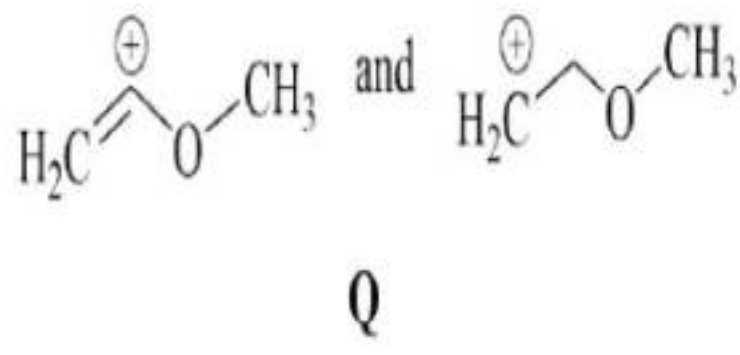
Question Number : 28 Question Id : 4146641162 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

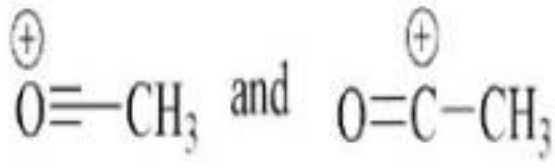
Among the following pairs,



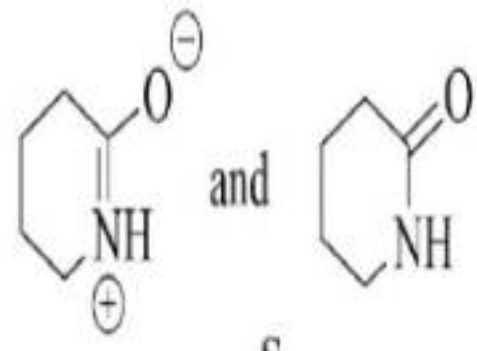
P



Q



R



S

the pairs that represent resonance structures are

Options :

4146644573. ✖ **P**, **Q** and **R**

4146644574. ✖ **Q**, **R** and **S**

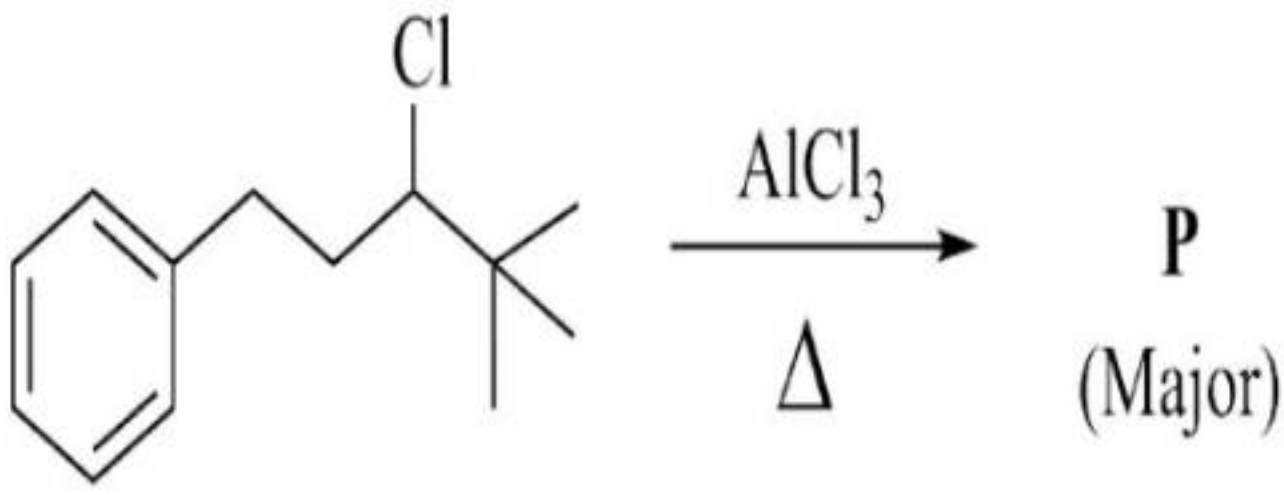
4146644575. ✖ **Q** and **S**

4146644576. ✔ **R** and **S**

Question Number : 29 Question Id : 4146641163 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

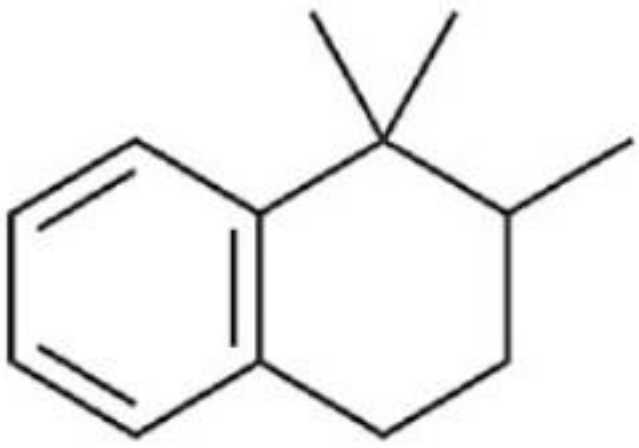
In the reaction shown below,



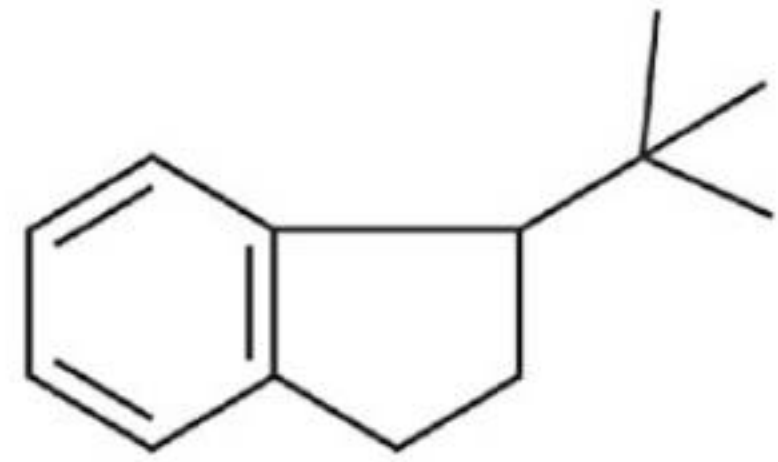
the product **P** is

Options :

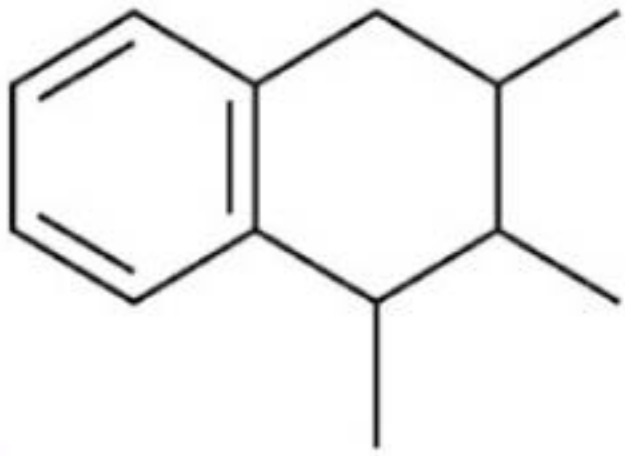
4146644577. ✔



4146644578.



4146644579.



4146644580.

Sub-Section Number :	2
Sub-Section Id :	414664163
Question Shuffling Allowed :	Yes
Is Section Default? :	null

Question Number : 30 Question Id : 4146641164 Question Type : MSQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 4 Wrong Marks : 0 Max. Selectable Options : 0

The reaction of the alkali metals with oxygen results in the formation of different alkali metal oxides, monoxides, peroxides and superoxides. These oxides have interesting chemical properties and applications. The ease of formation and stability of these oxides depend mainly on the charge and size of the alkali metals in relation to the size of the anions. In an application like in a space suit, a chemical may be used which gives oxygen and also absorbs carbon dioxide from exhalation. In this context, the correct statement(s) is(are):

Options :

4146644581. ✖ The order of the stability of alkali metal monoxides is $Li_2O < Na_2O < K_2O$.

4146644582. ✖ Superoxide formation decreases down the group.

4146644583. ✔ Na_2O_2 on reaction with CO_2 gives Na_2CO_3 and itself gets oxidized to oxygen.

4146644584. ✔ Potassium superoxide can be used in a space suit.

Question Number : 31 Question Id : 4146641165 Question Type : MSQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 4 Wrong Marks : 0 Max. Selectable Options : 0

Negatively charged monodentate strong field ligand (X^-) and weak field ligand (Y^-) form complexes $[MnX_6]^{4-}$ and $[MnY_6]^{4-}$, respectively, under certain reaction conditions. Let the crystal field splitting energy for $[MnX_6]^{4-}$ and $[MnY_6]^{4-}$ be $(\Delta_o)_1$ and $(\Delta_o)_2$, respectively. The correct statement(s) is(are):

Options :

4146644585. ✔ Electron pairing energy in $[MnX_6]^{4-}$ is smaller than $(\Delta_o)_1$.

4146644586. ✖ $[MnY_6]^{4-}$ is more stabilized than $[MnX_6]^{4-}$.

4146644587. ✔ The t_{2g} orbitals in $[MnX_6]^{4-}$ are stabilized by $2(\Delta_o)_1$ as compared to degenerate d orbitals.

4146644588. ✖ $[MnY_6]^{4-}$ is intense in colour as compared to $[MnX_6]^{4-}$.

Question Number : 32 Question Id : 4146641166 Question Type : MSQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 4 Wrong Marks : 0 Max. Selectable Options : 0

The bonding in the species HeH can be studied in a way similar to that of the H_2. The correct statement(s) is(are):

Options :

4146644589. ✔ The dipole moment of HeH is larger than that of H_2^+.

4146644590. ✖ Among HeH, HeH^+, and HeH^{2+}, the species that is most stable is HeH^{2+}.

4146644591. ✔ Among HeH, HeH^-, and HeH^+, the system with the smallest bond length is HeH^+.

4146644592. ✔ HeH^+ has symmetrical distribution of electrons about the bond axis.

Question Number : 33 Question Id : 4146641167 Question Type : MSQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 4 Wrong Marks : 0 Max. Selectable Options : 0

The hydrolysis of sucrose in excess acid solution follows first-order kinetics and results in D-glucose and D-fructose. Since, sucrose, D-glucose, and D-fructose are optically active compounds, the progress of the reaction can be monitored by measuring the angle of rotation of the polarized light in a polarimeter at different times. In a certain experiment, 1 L of 0.1 M sucrose solution is hydrolyzed and the angle of rotation (R_t) is measured at different times (t). Let $R_0 = 25°$, $R_\infty = -15°$, and $R_{30} = 5°$ be the angles of rotation at times $t = 0$ min, $t = \infty$, and $t = 30$ min respectively. The concentration of sucrose at time t is proportional to the change in the angle of rotation ($R_t - R_\infty$). Molecular mass of sucrose is 342.3 g/mol. The correct statement(s) is(are):

Options :

4146644593. ✖ The half-life of the reaction is 15 min.

4146644594. ✔ The rate constant (k) is 3.85×10^{-4} s^{-1}.

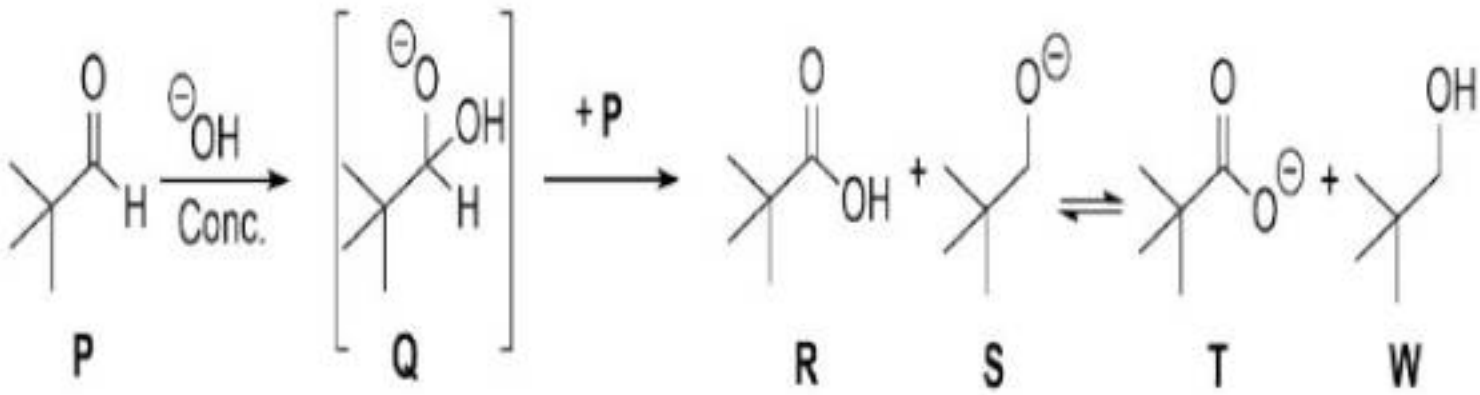
4146644595. ✔ The mass of sucrose hydrolysed in 60 min is 25.6 g.

4146644596. ✔ The rate of the reaction at 30 min is 1.925×10^{-5} Ms^{-1}.

Question Number : 34 Question Id : 4146641168 Question Type : MSQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 4 Wrong Marks : 0 Max. Selectable Options : 0

Consider the following mechanism of a reaction.



The correct statement(s) is(are):

Options :

4146644597. ✖ The same mechanism will operate, if compound **P** does not have one of the methyl groups.

4146644598. ✔ The reaction involves both oxidation and reduction of **P**.

4146644599. ✔ The equilibrium is favoured towards products **T** and **W** because **T** and **W** are weaker conjugate base and acid as compared to **R** and **S** respectively.

4146644600. ✔ Hydride is a nucleophile in the reaction of **Q** with **P** .

Mathematics

Section Id : 41466480

Section Number :	3 Online
Section type :	Mandatory
Mandatory or Optional :	17 17 50
Number of Questions :	
Number of Questions to be attempted :	
Section Marks :	
Enable Mark as Answered Mark for Review and Clear Response :	Yes
Maximum Instruction Time :	0
Sub-Section Number :	1
Sub-Section Id :	414664164
Question Shuffling Allowed :	Yes
Is Section Default? :	null

Question Number : 35 Question Id : 4146641169 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

Let $g : \mathbb{R} \mapsto \mathbb{R}$ be a differentiable function such that $g(x)g'(x) > 0$ for all $x \in \mathbb{R}$.
Then

Options :

4146644601. ✖ g is increasing.

4146644602. ✖ g is decreasing.

4146644603. ✔ $|g|$ is increasing.

4146644604. ✖ $|g|$ is decreasing.

Question Number : 36 Question Id : 4146641170 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

The number of real roots of $f(x) = x^6 + x^3 - 1$ is

Options :

4146644605. ✗ 0

4146644606. ✓ 2

4146644607. ✗ 4

4146644608. ✗ 6

Question Number : 37 Question Id : 4146641171 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

In a throw of a (biased single) dice, the probability of the outcome being a number n is $\frac{1}{4}$ if n is even, and $\frac{1}{12}$ if n is odd. If the dice is thrown twice, then the probability that the sum of the two outcomes is an even number is

Options :

4146644609. ✗ $\frac{3}{8}$

4146644610. ✖ $\frac{1}{2}$

4146644611. ✔ $\frac{5}{8}$

4146644612. ✖ $\frac{3}{4}$

Question Number : 38 Question Id : 4146641172 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

$$\text{Define } \operatorname{sgn}(x) = \begin{cases} 1, & \text{if } x > 0, \\ -1, & \text{if } x < 0, \\ 0, & \text{if } x = 0. \end{cases}$$

Let $f : \mathbb{R} \to \mathbb{R}$ be the function defined by $f(x) = (x - \sqrt{5})\operatorname{sgn}(x^2 - 5)$. Then the number of discontinuities of f is

Options :

4146644613. ✖ 0

4146644614. ✔ 1

4146644615. ✖ 2

4146644616. ✖ 3

Question Number : 39 Question Id : 4146641173 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

Let S be the set of all natural numbers x such that

(i) $100 \leq x \leq 999$,

(ii) 0 appears at least once as a digit in the decimal expansion of x, and

(iii) the sum of the digits of x is 10.

Then the number of elements in S is

Options :

4146644617. ✔ 18

4146644618. ✖ 20

4146644619. ✖ 27

4146644620. ✖ 30

Question Number : 40 Question Id : 4146641174 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum

Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

The horizontal line $y = k$ intersects the parabola $y = 2(x-4)(x-6)$ at points A and B. If the length of AB is 8, then the value of k is

Options :

4146644621. ✔ 30

4146644622. ✖ 10

4146644623. ✖ 20

4146644624. ✖ 8

Question Number : 41 Question Id : 4146641175 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

Let $S(n) = \frac{1}{n^4}\sum_{l=1}^{n}(l+2)(l+4)(l+6)$. The value of $\lim_{n\to\infty} S(n)$ is

Options :

4146644625. ✖ $\frac{1}{6}$

4146644626. ✖ $\frac{1}{2}$

4146644627. ✔ $\frac{1}{4}$

4146644628. ✖ 1

Question Number : 42 Question Id : 4146641176 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

Let α be a complex number such that $\alpha \neq 1$ and $\alpha^5 = 1$. Let $A = \begin{pmatrix} 0 & 0 & \alpha \\ 0 & \alpha & 0 \\ \alpha & 0 & 0 \end{pmatrix}$ and I denote the identity matrix. Then the value of $I + A + A^2 + A^3 + A^4$ is

Options :

4146644629. ✔ $(1+\alpha^2+\alpha^4)\begin{pmatrix} 1 & 0 & -1 \\ 0 & 0 & 0 \\ -1 & 0 & 1 \end{pmatrix}$

4146644630. ✖ $\alpha(1+\alpha^2)\begin{pmatrix} 1 & 0 & -1 \\ 0 & 0 & 0 \\ -1 & 0 & 1 \end{pmatrix}$

4146644631. ✖ $(1+\alpha^2+\alpha^4)\begin{pmatrix} -1 & 0 & 1 \\ 0 & 0 & 0 \\ 1 & 0 & -1 \end{pmatrix}$

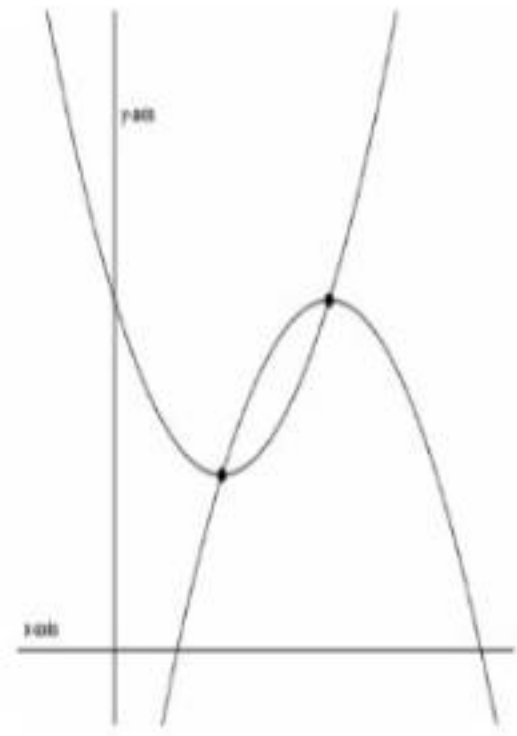
$$(1+\alpha^2+\alpha^4)\begin{pmatrix}-1 & 0 & 1\\ 0 & 1 & 0\\ 1 & 0 & -1\end{pmatrix}$$

4146644632. ✖

Question Number : 43 Question Id : 4146641177 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

Let P and Q be the vertices of the parabolae $y = x^2+bx+c$ and $y = -x^2+dx+e$, respectively.



If P and Q are the points of intersection of the parabolae then the slope of the line through P and Q is

Options :

4146644633. ✖ $\dfrac{c+e}{2}$

4146644634. ✖ $\dfrac{c+d}{2}$

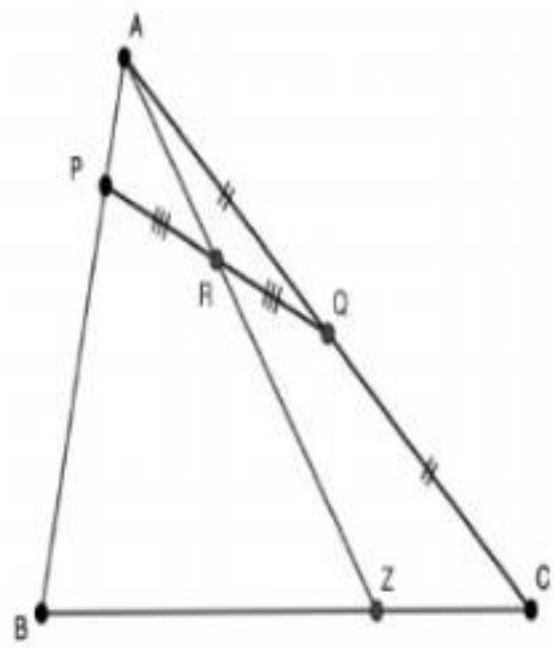
4146644635. ✔ $\frac{b+d}{2}$

4146644636. ✖ $\frac{b+e}{2}$

Question Number : 44 Question Id : 4146641178 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

Let ABC be a triangle with $AC = 2048$, $AB = 512$ and $BC = 2000$. Let P be a point on the segment AB such that $AP = 1$ and Q be a point on the segment AC such that $AQ = 1024$. Let R be the midpoint of PQ. Let Z be the point of intersection of AR and BC.



Then the length of ZC is

Options :

4146644637. ✖ $\frac{2000}{256}$

4146644638. ✔ $\frac{2000}{257}$

4146644639. ✖ $\frac{1000}{256}$

4146644640. ✖ $\frac{1000}{257}$

Question Number : 45 Question Id : 4146641179 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

Let $f : \mathbb{R} \to \mathbb{R}$ be a continuous function such that $f(0) = 1$ and

$$|f(x) - f(y)| \leq |\sin\{(x-y)^2\}| \text{ for all } x, y \in \mathbb{R},$$

and let g be the function defined by $g(x) = x^2 f(x^2)$ for all $x \in \mathbb{R}$. Then the value of $g'(2)$ is

Options :

4146644641. ✖ 2

4146644642. ✔ 4

4146644643. ✖ 6

4146644644. ✖ 0

Question Number : 46 Question Id : 4146641180 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

Let $n \geq 3$ be an integer. Let $P_1, P_2, \ldots, P_{2n}$ be points in the plane, which are the vertices of a regular $2n$-gon. The number of obtuse-angled triangles with vertices contained in the set $\{P_1, P_2, \ldots, P_{2n}\}$ is

Options :

4146644645. ✔ $n(n-1)(n-2)$

4146644646. ✖ $\frac{n^2(n-1)(n-2)}{3}$

4146644647. ✖ $\frac{n(n-1)^2}{2}$

4146644648. ✖ $2n(2n-1)(2n-2)$

Sub-Section Number :	2
Sub-Section Id :	414664165
Question Shuffling Allowed :	Yes
Is Section Default? :	null

Question Number : 47 Question Id : 4146641181 Question Type : MSQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum

Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 4 Wrong Marks : 0 Max. Selectable Options : 0

If A, B, C are 3×3 matrices with entries in $\mathbb{R}$, satisfying the condition $AB = AC$, then

Options :

4146644649. ✖ the determinant of AB is 0.

4146644650. ✖ either A is the zero matrix or $B = C$.

4146644651. ✔ either $B = C$ or A is not an invertible matrix.

4146644652. ✔ either A is the zero matrix or the determinant of $B - C$ is zero.

Question Number : 48 Question Id : 4146641182 Question Type : MSQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 4 Wrong Marks : 0 Max. Selectable Options : 0

Let X, Y, Z be sets and $f\colon X \to Y$ and $g\colon Y \to Z$ be functions. Then

Options :

4146644653. ✔ $g \circ f$ being injective implies f injective.

4146644654. ✔ $g \circ f$ being surjective implies g surjective.

4146644655. ✖ $g \circ f$ being injective implies g injective.

g being surjective implies $g \circ f$ surjective.

4146644656. ✖

Question Number : 49 Question Id : 4146641183 Question Type : MSQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 4 Wrong Marks : 0 Max. Selectable Options : 0

Let $f : (0,3) \cup (6,9) \to \mathbb{R}$ be a differentiable function such that $f'(x) = \frac{1}{2}$ for all $x \in (0,3) \cup (6,9)$. Then

Options :

4146644657. ✖ f is an increasing function.

4146644658. ✖ f is a one to one function.

4146644659. ✔ $f(8) - f(7) = f(2) - f(1)$.

4146644660. ✔ there exists a number c in $\mathbb{R}$ such that $f(x+6) = f(x)+c$ for all $x \in (0,3)$.

Question Number : 50 Question Id : 4146641184 Question Type : MSQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 4 Wrong Marks : 0 Max. Selectable Options : 0

Let A and B be two points on the parabola $y - 2x^2 = 0$ and O be the origin $(0,0)$. If

Options :

4146644661. ✖ OAB is an isosceles triangle then the y coordinates of A and B are equal.

4146644662. ✔ OAB is an equilateral triangle then the length of each side is $\sqrt{3}$.

4146644663. ✖ OAB is an isosceles triangle and the two equal sides are of length $\sqrt{3}$ then OAB is an equilateral triangle.

4146644664. ✖ OAB is an equilateral triangle then its altitude is $\sqrt{3}$.

Question Number : 51 Question Id : 4146641185 Question Type : MSQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 4 Wrong Marks : 0 Max. Selectable Options : 0

Let $f : [0,1] \to \mathbb{R}$ be a continuous function and P be a polynomial of degree 4 with coefficients in $\mathbb{R}$. If $P(f(x)) = 0$ for all $x \in \mathbb{R}$, then

Options :

4146644665. ✖ $f(x) = 0$ for all $x \in \mathbb{R}$.

4146644666. ✔ f is a constant function.

4146644667. ✖ for all continuous functions g, there exists $x \in [0,1]$ such that $P(g(x)) = 0$.

4146644668. ✔ P has at most two roots which do not belong to $\mathbb{R}$.

Physics

Section Id :	41466481
Section Number :	4 Online
Section type :	Mandatory
Mandatory or Optional :	17 17 50
Number of Questions :	
Number of Questions to be attempted :	
Section Marks :	
Enable Mark as Answered Mark for Review and Clear Response :	Yes
Maximum Instruction Time :	0
Sub-Section Number :	1
Sub-Section Id :	414664166
Question Shuffling Allowed :	Yes
Is Section Default? :	null

Question Number : 52 Question Id : 4146641186 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

A thin spherical copper shell of radius R, completely filled with a viscous fluid, is rotating about the vertical axis with a constant angular speed ω_0. Due to a leak at the bottom of the shell, the fluid starts dripping steadily and vertically from the shell. The net change in angular speed $(\delta\omega)$ when the shell gets empty is

Options :

4146644669. ✖ proportional to R^2.

4146644670. ✔ proportional to R.

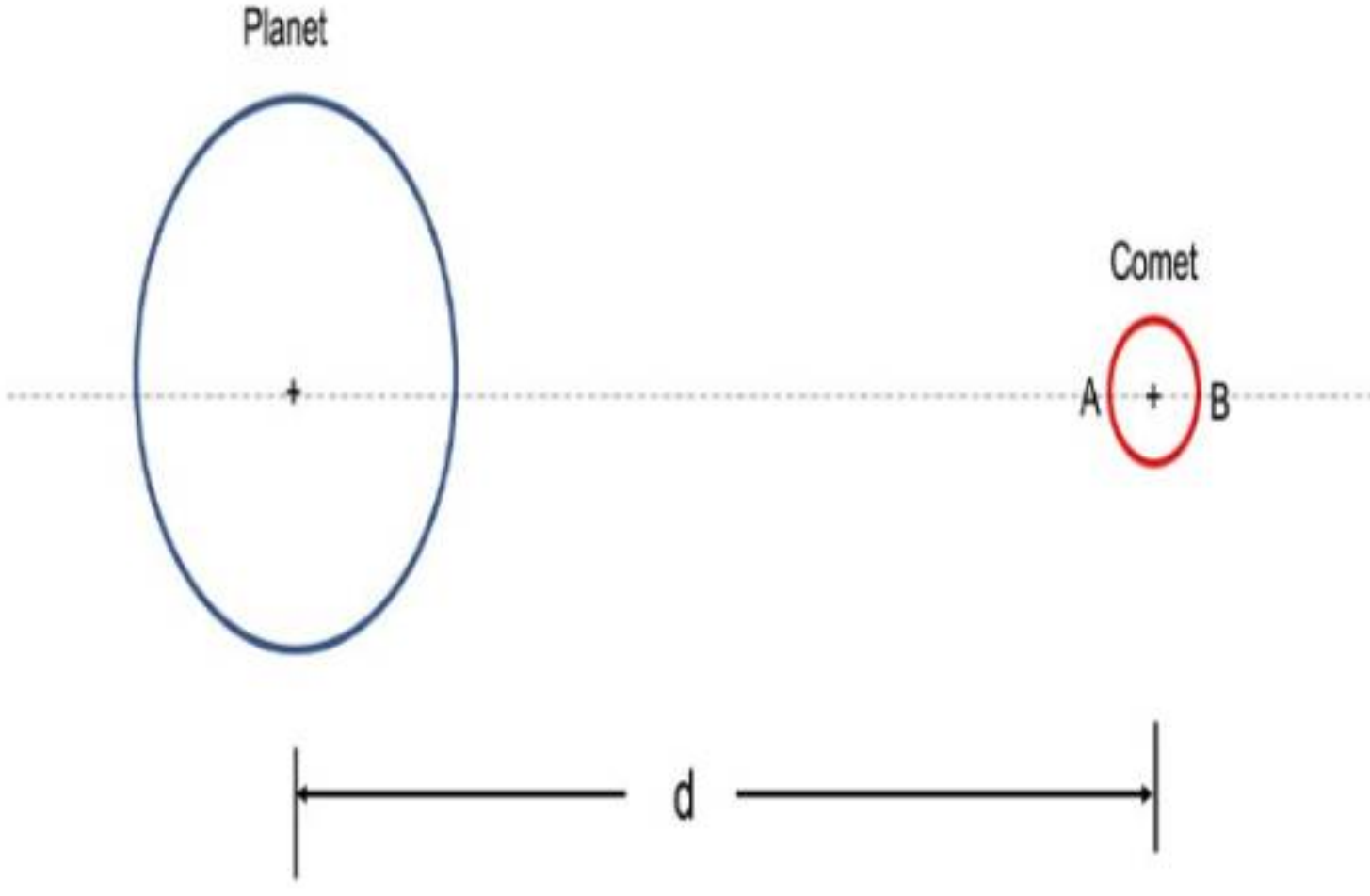
4146644671. ✖ proportional to R^3.

4146644672. ✖ independent of R.

Question Number : 53 Question Id : 4146641187 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

A spherical comet having mass M_s and radius r is moving towards a planet of mass M_p as shown in the figure. At a separation distance d, equal gravitational force is experienced by the two identical test masses (m) which are placed at diametrically opposite ends (A and B) of the comet. Assuming $d \gg r$, the correct choice about the separation distance d is,



Options :

4146644673. ✔ d is proportional to $M_p^{1/3}$.

4146644674. ✖ d is proportional to $M_s^{2/3}$.

4146644675. ✖ d is independent of r.

4146644676. ✖ d is inversely proportional to $M_s^{2/3}$.

Question Number : 54 Question Id : 4146641188 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

A metal rod, connected between two high voltage electrodes, attains steady-state temperature through a balance between radiated power loss and Joule heating. The temperature of the surrounding is neglegible compared to that of the rod and the resistance of the rod is independent of its temperature. Assuming the current through the rod to be I, the dominant wavelength of radiation(λ) is given by $\lambda \propto I^{\alpha}$. Then, the value of α is

Options :

4146644677. ✖ 1.0

4146644678. ✔ -0.5

4146644679. ✖ 2.0

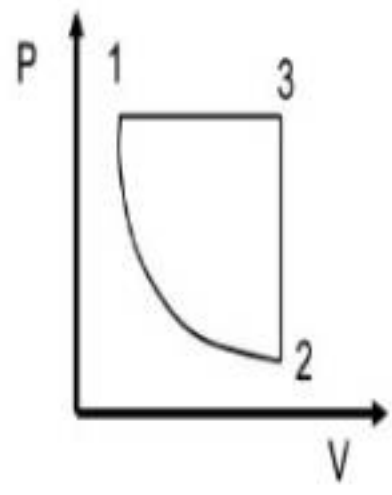
4146644680. ✖ -1.0

Question Number : 55 Question Id : 4146641189 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

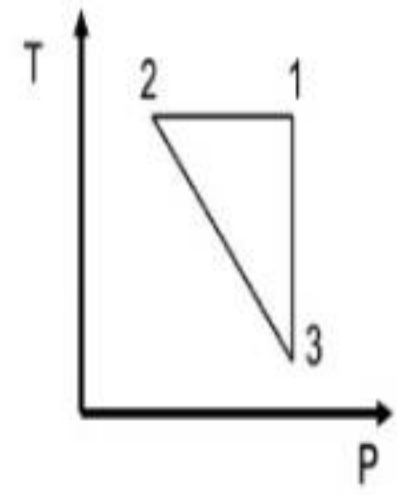
Correct Marks : 2.5 Wrong Marks : 1

Thermodynamic processes (P_1,P_2,P_3,P_4) in which an ideal gas passes through states 1, 2 and 3 are shown in the figure where P, V, T are pressure, volume and temperature, respectively . The process(processes) that could be identical to the process P_1 is (are)

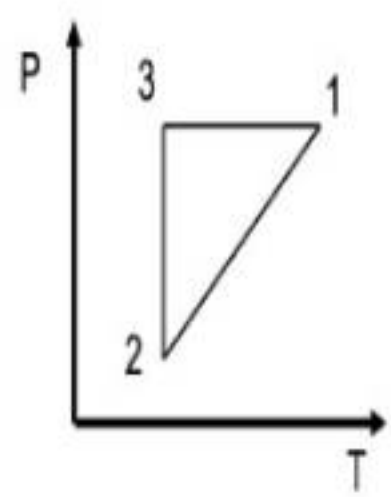
(P_1)



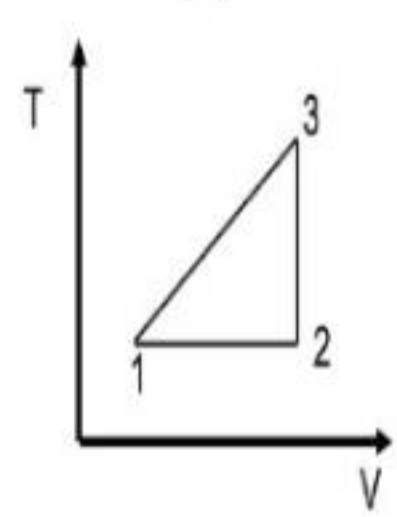
(P_2)



(P_3)



(P_4)



Options :

4146644681. ✖ P_2 only.

4146644682.

P_2 and P_3 only.

4146644683. P_3 and P_4 only.

4146644684. ✔ P_2 and P_4 only.

Question Number : 56 Question Id : 4146641190 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

A proton accelerated from rest by a potential difference of V volts has a de Broglie wavelength of 0.20Å (1.0 Å $=10^{-10}$ m). A fully ionized Helium atom is similarly accelerated by a potential difference of 2V volts. Its de Broglie wavelength (Å) is closest to

Options :

4146644685. ✔ 0.05

4146644686. 0.07

4146644687. 0.10

4146644688. 0.20

Question Number : 57 Question Id : 4146641191 Question Type : MCQ Option Shuffling : Yes Is

Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

Consider the Bohr model of the hydrogen atom with Bohr radius a_B. If the mass of the electron and that of the proton become twice the present values, then the new Bohr radius will

Options :

4146644689. ✖ remain unchanged.

4146644690. ✖ change to $2a_B$.

4146644691. ✔ change to $a_B/2$.

4146644692. ✖ change to $4a_B$.

Question Number : 58 Question Id : 4146641192 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

Two radioactive samples X and Y have the same number of atoms initially $[N_X(t = 0) = N_Y(t = 0)]$. The half life $\tau^x_{1/2}$ of X is half the mean life of Y. Then $N_Y(t)$ is seven times $N_X(t)$ when $t/\tau^x_{1/2}$ is closest to

Options :

4146644693. ✖ 1

4146644694. ✖ 2

4146644695. ✖ 5

4146644696. ✔ 10

Question Number : 59 Question Id : 4146641193 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

An elastic conducting ring of mass m is extended radially with constant speed v in an uniform magnetic field of strength B which is perpendicular to the plane of the ring. Take the resistance R of the ring to be a constant. The magnetic moment (μ) of the ring in terms of the instantaneous radius of the ring (r) is given by $\mu = Kr^{\alpha}$ where K and α are constants. Then, the value of α is

Options :

4146644697. ✖ 0

4146644698. ✖ 1

4146644699. ✖ 4

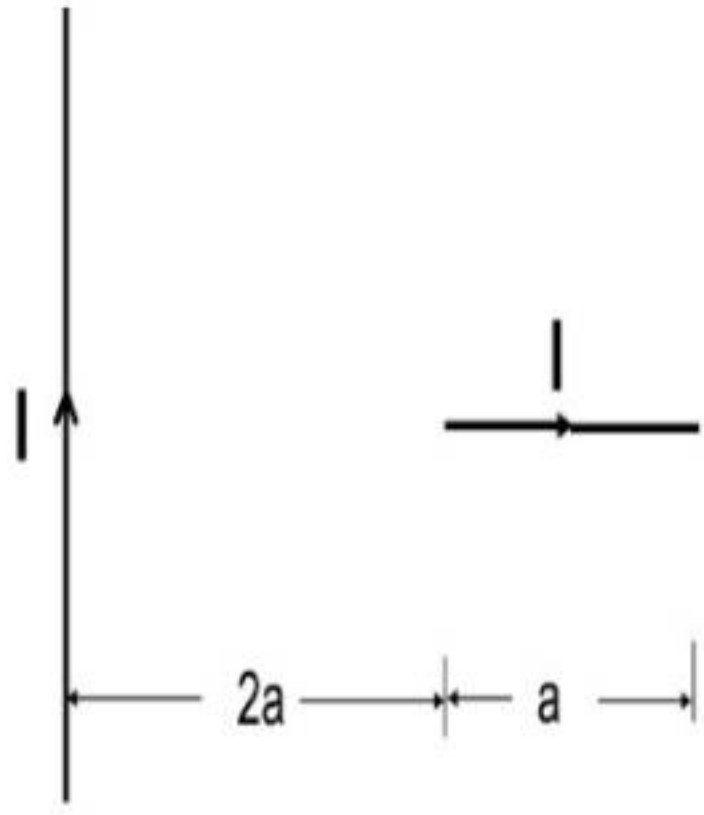
4146644700. ✔ 3

Question Number : 60 Question Id : 4146641194 Question Type : MCQ Option Shuffling : Yes Is

Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

A horizontal straight wire of length a is placed perpendicular to a long current carrying straight vertical wire at a distance of $2a$ and lies in the same plane as shown in the figure. Both wires carry steady current I. The magnitude of the force on the horizontal wire due to the vertical wire is



Options :

4146644701. ✔ $\dfrac{\mu_0 I^2 \ln(3/2)}{2\pi}$

4146644702. ✖ 0

4146644703. ✖ $\dfrac{\mu_0 I^2 \ln 3}{\pi}$

4146644704. ✖ $\dfrac{3\mu_0 I^2 \ln 2}{2\pi}$

Question Number : 61 Question Id : 4146641195 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

A double convex lens of the objective is changed to plano-convex. The objective is made of a plastic material with refractive index 1.3. Then,

Options :

4146644705. ✖ the numerical aperture of the double convex lens is 1.3.

4146644706. ✔ the numerical aperture of the plano-convex lens is 0.39.

4146644707. ✖ the diameter to focal length ratio of the plano-convex lens is 1.2.

4146644708. ✖ the critical angle of the double convex lens is 60°.

Question Number : 62 Question Id : 4146641196 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 2.5 Wrong Marks : 1

An elastic wave generates a stress of magnitude N while propagating in a wire. The relation between its frequency ω and the wavevector k is given by $\omega = \omega_0\sqrt{1-\cos ka}$, where ω_0 iand a are constants. In the long wavelength approximation ($\lambda \gg a$), the linear density of the wire is

Options :

4146644709. ✖ $2N/(\omega_0 a)$

4146644710. ✖ $\omega_0 a/N$

4146644711. ✔ $2N/\left(\omega_0 a\right)^2$

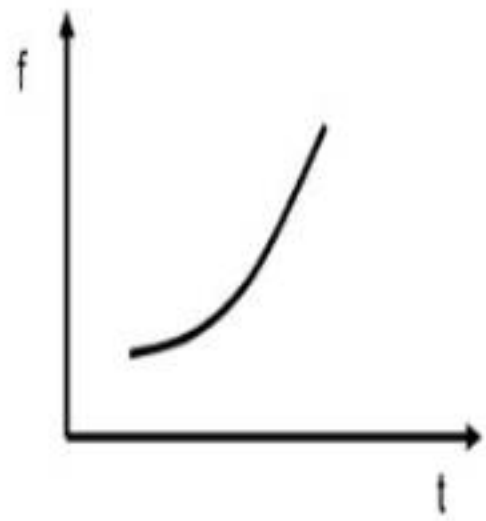
4146644712. ✖ $N/\left(\omega_0^2 a\right)$

Question Number : 63 Question Id : 4146641197 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

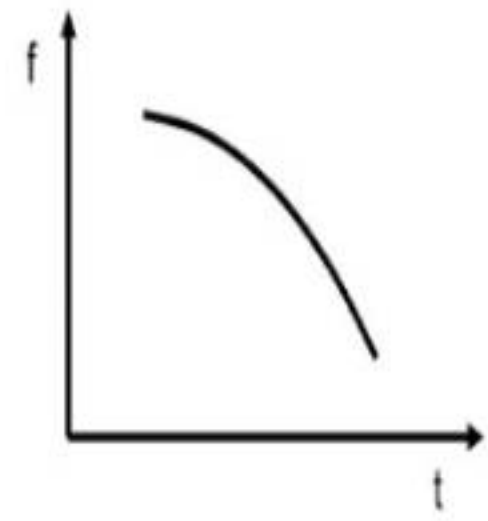
Correct Marks : 2.5 Wrong Marks : 1

A slow steady stream of water is falling onto a tall cylindrical bucket. Let $f(t)$ denote the dominant frequency of the sound of the fall onto the horizontal water surface in the bucket. The possible time dependences of this frequency are shown in the figures. The graph which best describes the variation of f with t qualitatively is

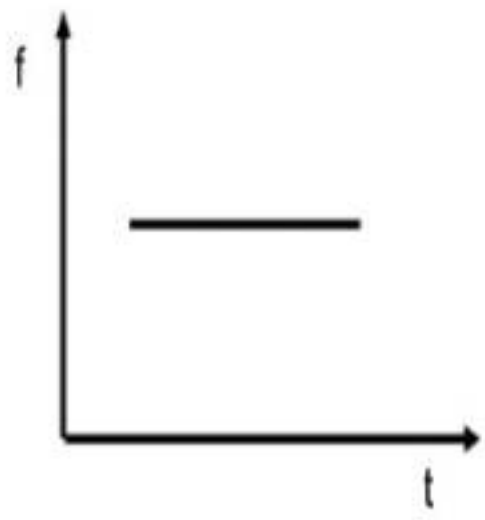
(P)



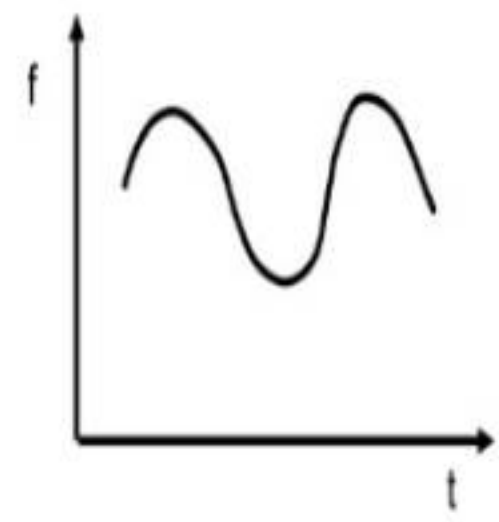
(Q)



(R)



(S)



Options :

4146644713. ✔ P

4146644714. ✖ Q

4146644715. ✖ R

4146644716. ✖ S

Sub-Section Number : 2

Sub-Section Id : 414664167

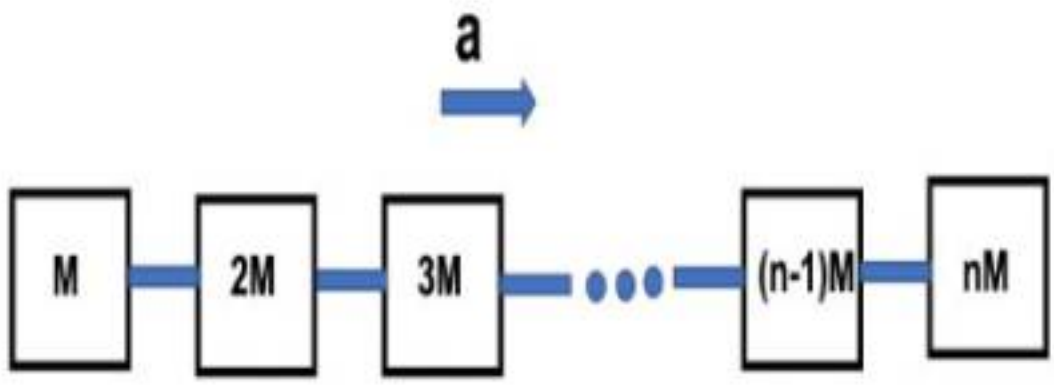
Question Shuffling Allowed : Yes

Is Section Default? : null

Question Number : 64 Question Id : 4146641198 Question Type : MSQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 4 Wrong Marks : 0 Max. Selectable Options : 0

An accelerating train (acceleration $a = 1\ \text{m}\cdot\text{s}^{-2}$) of n blocks have a mass distribution as shown in the figure. The rightmost block of mass nM is the engine. The blocks are connected through a Aluminum cable of cross-section 10 cm^2. The maximum allowed strain in the connecting cables is 0.001. Taking $M = 1000$ kg and Young's modulus of Aluminum to be 7×10^{10} Pa, the correct choice(s) is(are).



Options :

4146644717. ✖ all connecting cables will have equal strain.

4146644718. ✔ the difference of stress in any two consecutive cables is in arithmetic progression.

4146644719. ✔ the train can have at most 12 blocks.

4146644720. ✖ the maximum stress is between blocks having masses M and $2M$.

Question Number : 65 Question Id : 4146641199 Question Type : MSQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 4 Wrong Marks : 0 Max. Selectable Options : 0

A point object P of mass m and charge q is placed at a distance r from a stationary object Q of mass M and charge $-q$. Let T_g be the time for P to reach Q if it is moving only under gravitational attraction. Similarly, let T_e be the time for P to reach Q if it is moving only under electrostatic attraction. Then,

Options :

4146644721. ✔ T_g depends on M but not on m.

4146644722. ✔ T_e depends on m but not on M.

4146644723. ✖ T_g^2 is directly proportional to G.

4146644724. ✔ T_e^2 is directly proportional to ϵ_0.

Question Number : 66 Question Id : 4146641200 Question Type : MSQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 4 Wrong Marks : 0 Max. Selectable Options : 0

The correct statement(s) about an ideal gas is(are)

Options :

4146644725. ✔ for an adiabatic process, the work-done does not depend upon the path.

for an isobaric process, the change in enthalpy is equal to the net heat input to the system.

4146644726. ✔

the total potential energy of an ideal gas can be a function of time.

4146644727. ✖

for an isothermal process, the entropy of an ideal gas remains constant.

4146644728. ✖

Question Number : 67 Question Id : 4146641201 Question Type : MSQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 4 Wrong Marks : 0 Max. Selectable Options : 0

The electrostatic potential in the region between two long coaxial cylinders of radii a and b is given by $\phi = \alpha \ln(r/a) + \beta$, where α and β are constants. Here, $\alpha > 0$ and r denotes radial distance from the axis such that $a < r < b$. Then, the correct option(s) is (are)

Options :

The charge per unit length on the inner cylinder is $-(2\pi\epsilon_0\alpha)$.

4146644729. ✔

Capacitance per unit length is $\ln(b/a)/(2\pi\epsilon_0)$.

4146644730. ✖

The charge density on the outer cylinder is $-(\epsilon_0\alpha)/b^2$.

4146644731. ✖

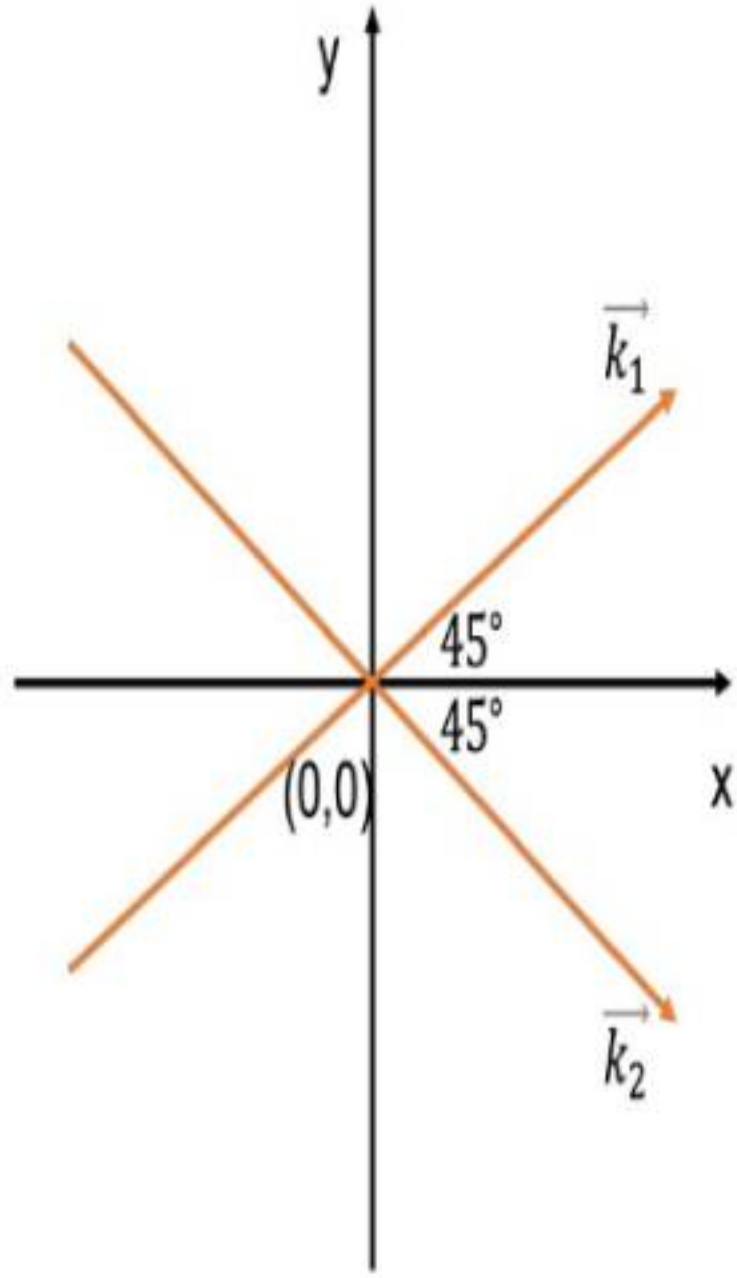
The electric field in the region between two cylinders is $-(\alpha/r)\hat{r}$.

4146644732. ✔

Question Number : 68 Question Id : 4146641202 Question Type : MSQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0 Option Orientation : Vertical

Correct Marks : 4 Wrong Marks : 0 Max. Selectable Options : 0

Two plane waves having amplitude E_0 are described by $\vec{E}_1 = E_0 \cos\left(\vec{k_1} \cdot \vec{r} - \omega t\right) \hat{z}$ and $\vec{E}_2 = E_0 \cos\left(\vec{k_2} \cdot \vec{r} - \omega t\right) \hat{z}$. The wavevectors $\vec{k}_1$ and $\vec{k}_2$ pass through the origin making an angle of $45°$ with x-axis, as shown in the figure. At $t = 0$ and $x = 0$ plane, the correct option(s) is(are)



Options :

4146644733. ✔ the periodicity of interfence pattern in the yz plane is $\sqrt{2}\lambda$.

4146644734. ✔ the amplitude of resultant wave is $2E_0$.