NATIONAL ENTRANCE SCREENING TEST
NEST 2019

Section : **General**

Q.1 In history of science, there are numerous examples of female scientists associated with opening of new areas of research through their trailblazing work. Some female scientists and the research avenues opened by them are listed below. Choose the **incorrect** pair.

Ans
✗ 1. Jocelyn Bell - pulsars

✗ 2. Vera Rubin - dark matter

✓ 3. Jane Goodall - human genome

✗ 4. Marie Curie - radioactivity

Question Type :	**MCQ**
Question ID :	**4941032017**
Status :	**Answered**
Chosen Option :	**3**
Marks :	**3.00**

Q.2 n is an odd integer which gives a remainder r when divided by 8. Choose the **incorrect** statement.

Ans
✗ 1. when n^3 is divided by 8, the remainder is always r.

✗ 2. when $(n+1)^3$ is divided by 8, the remainder is always 0.

✗ 3. when n^2 is divided by 8, the remainder is always 1.

✓ 4. when $(n+1)^2$ is divided by 8, the remainder is always 4.

Question Type :	**MCQ**
Question ID :	**4941032018**
Status :	**Answered**
Chosen Option :	**4**
Marks :	**3.00**

Q.3 Among the following the state that does **not** share its border with six or more neighbouring states is

Ans
✗ 1. Assam.

✗ 2. Chhattisgarh.

✗ 3. Karnataka.

✓ 4. Madhya Pradesh.

Question Type :	**MCQ**
Question ID :	**4941032021**
Status :	**Answered**
Chosen Option :	**1**

Marks : **0.00**

Q.4 Choose the **incorrect** statement.

Ans
- ✗ 1. Diagonals of a rectangle bisect each other.
- ✔ 2. Diagonals of a kite bisect each other at a right angle.
- ✗ 3. Diagonals in a rhombus bisect each other at a right angle.
- ✗ 4. Diagonals of a parallelogram bisect each other.

Question Type : **MCQ**
Question ID : **4941032020**
Status : **Answered**
Chosen Option : **2**
Marks : **3.00**

Q.5 Craving for non-food items such as chalk, soil, petrol and paint is often associated with deficiency of

Ans
- ✔ 1. Iron and Zinc.
- ✗ 2. Copper and Calcium.
- ✗ 3. Iron and Selenium.
- ✗ 4. Calcium and Selenium.

Question Type : **MCQ**
Question ID : **4941032019**
Status : **Answered**
Chosen Option : **2**
Marks : **0.00**

Comprehension:

The ability of *Homo sapiens* to adapt in case of adversities (like a change in environment), allowed them an evolutionary advantage. About 70,000 - 30,000 years ago, *Homo sapiens* developed large societies comprising of thousands of people to establish dominance over the earth. This was the era when there was a revolution in their cognitive abilities enabling new ways of thinking, reasoning and communicating. Since then, languages evolved to not only facilitate the sharing of facts but also to create fictional entities, such as 'social constructs' and 'imagined realities'. While the social constructs lead to sophisticated cooperation among people, the imagined realities enable the transmission of information about things that do not exist at all. Such fictional entities capacitate a large population to collectively believe in things that they have never seen, touched or smelt. These ideas, ranging from the common myths of old religious texts to the myths of modern nation states, have enabled *Homo sapiens* to cooperate flexibly in enormously large numbers.

Consider the case of two priests following a particular religion and who have never met. They still can work together believing that their god was incarnated in human flesh and had lived a particular life. Similarly, two lawyers who have never met can also combine efforts to defend an imagined reality called a *public limited company*, which can continue to exist even if all its real components consisting of founding members, workers, material properties cease to exist. On the other hand, such a company with all its people and material property intact, can cease to exist if a court passess a judgment based on a book of abstract set of principles called laws. These 'imagined realities' now play the biggest role in the protection of our real natural environment and the survival of our species.

Social constructs emerge from human interactions, and help understand and shape everyday realities. Under the right circumstances the 'social constructs' that enable large scale cooperation in people can change very rapidly. For instance, in late eighteenth century the French population switched almost overnight from believing in the myth of the divine right of the king to the myth of the sovereignty of people.

(Adapted from the book "Sapiens" by Yuvan Noah Harari)

SubQuestion No : 6

Q.6 The most important cognitive ability that has given *Homo sapiens* an evolutionary advantage is the ability to

Ans ✗ 1. transmit information.

✗ 2. communicate using a language.

✗ 3. cooperate among peers.

✓ 4. create and communicate fictional entities.

Question Type :	**MCQ**
Question ID :	**4941032023**
Status :	**Answered**
Chosen Option :	**4**
Marks :	**3.00**

Comprehension:

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(Adapted from the book "Sapiens" by Yuvan Noah Harari)

SubQuestion No : 7

Q.7 The emergence of *Homo sapiens* as the dominant species on earth is best explained by

Ans ✗ 1.
their inability to believe in things that they have never touched, seen or smelt.

✗ 2. their rigid belief in the myth of old religious texts.

✗ 3. their creation of modern nation states.

✓ 4. their cognitive ability to overcome adversities.

Question Type :	**MCQ**
Question ID :	**4941032025**
Status :	**Answered**
Chosen Option :	**4**
Marks :	**3.00**

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(Adapted from the book "Sapiens" by Yuvan Noah Harari)

SubQuestion No : 8

Q.8 Select the **incorrect** statement.

Ans ✅ 1. The laws of a country are not imagined realities.

❌ 2.
During French revolution, the French population abandoned the myth of the king's divine right.

❌ 3.
The business entity called the public limited company is a fictional entity.

❌ 4. The imagined realities influence the survival of our species.

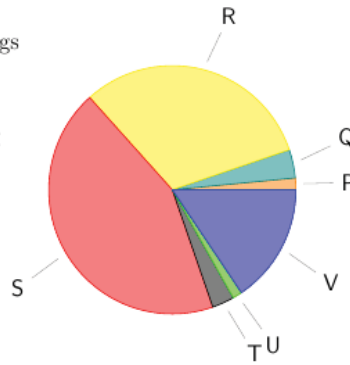|	
Question Type :	**MCQ**
Question ID :	**4941032024**
Status :	**Answered**
Chosen Option :	**1**
Marks :	**3.00**

Comprehension:

The pie chart below shows cause-wise distribution of total number of accidents that happened on Indian roads in the year 2015 (Source: National Crimes Record Bureau). There were 464971 accidents in total. The categories for reasons of accidents are as follows:

- P: Driver under influence of Alcohol / Drugs
- Q: Weather related reasons
- R: Careless driving / dangerous overtaking
- S: Overspeeding by the driver
- T: Mechanical failure in the vehicle
- U: Lack of road infrastructure
- V: Other / unknown causes

SubQuestion No : 9

Q.9 Percentage of accidents caused by Alcohol / Drugs (P), Weather (Q), Careless driving (R) and Overspeeding (S), taken together, is about

Ans ✗ 1. 70%

✔ 2. 80%

✗ 3. 60%

✗ 4. 50%

Question Type : **MCQ**
Question ID : **4941032028**
Status : **Answered**
Chosen Option : **2**
Marks : **3.00**

Comprehension:

The pie chart below shows cause-wise distribution of total number of accidents that happened on Indian roads in the year 2015 (Source: National Crimes Record Bureau). There were 464971 accidents in total. The categories for reasons of accidents are as follows:

- P: Driver under influence of Alcohol / Drugs
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- S: Overspeeding by the driver
- T: Mechanical failure in the vehicle
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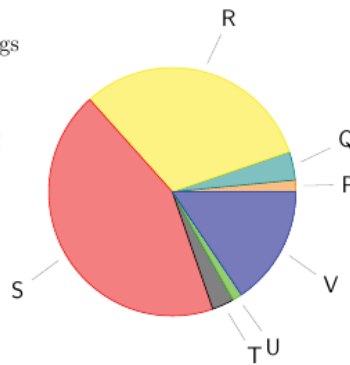
SubQuestion No : 10

Q.10 The number of accidents due to careless driving or dangerous overtaking (R) are

Ans ✗ 1. 201463

✔ 2. 146059

✗ 3. 71871

✗ 4. 98257

Question Type : **MCQ**
Question ID : **4941032027**
Status : **Answered**

Chosen Option : **2**

Marks : **3.00**

Section : **Biology**

Q.1 Arrange the following biological discoveries in the correct chronology from the earliest to the latest.

    i. British biochemist Frederick Sanger introduces his 'plus and minus' method for DNA sequencing.

    ii. American scientists Walter Gilbert and Allan Maxam introduce their method of DNA sequencing using chemical processes to terminate DNA strands.

    iii. Swiss physician Friedrich Miescher discovers and isolates DNA

    iv. Canadian-American researchers Oswald Avery and Colin Munro MacLeod, along with American geneticist Maclyn McCarty, working on experiments on pneumo-coccal bacteria, establish that DNA could transform the properties of cells.

    v. American biologist James Watson and English physicist Francis Crick discover the double helix when solving the three-dimensional structure of DNA, working from crystallographic data produced by Rosalind Franklin and Maurice Wilkins.

Ans ✔️ 1. iii-iv-v-i-ii

    ❌ 2. iv-iii-v-i-ii

    ❌ 3. iii-v-iv-ii-i

    ❌ 4. v-iii-iv-ii-i

Question Type : **MCQ**

Question ID : **4941032036**

Status : **Answered**

Chosen Option : **1**

Marks : **3.00**

Q.2 Each neuron has a cell body, axon, and dendrites. The dendrites are the protoplasmic extensions of the nerve cell. The axodendritic type of chemical synapse is formed by the association between the axon terminal of pre-synaptic neuron and dendrites of a post-synaptic neuron. Action potential causes the fusion of synaptic vesicle to release the neurotransmitters for neurotransmission. Select the correct option from the following.

Ans ❌ 1.

Dendrites are nothing but extensions of the axon terminals of presynaptic neuron.

    ❌ 2. Dendrites are equipped with nodes of Ranvier.

    ❌ 3.

Dendrites contain neurotransmitter-filled synaptic vesicles and the action potential stimulates fusion of these vesicles with its membranes.

    ✔️ 4.

Dendrites taking part in synapse formation are equipped with neurotransmitter receptors.

Question Type : **MCQ**

Question ID : **4941032038**

Status : **Answered**

Chosen Option : **4**

Marks : **3.00**

Q.3 The common morning glory (*Ipomoea purpurea*) exhibits two flower colours, where purple is dominant over pink. Within a population of common morning glory which is at genetic equilibrium, 9% of all flowers are pink. Assuming that there are no other compounding factors, what is the frequency of flowers in the population that are heterozygous.

Ans ❌ 1. 0.30

✗ 2. 0.70

✗ 3. 0.21

✔ 4. 0.42

Q.4 Seed traits of a given plant species following genetic inheritance are:
S = long, s = short;
W = wrinkled, w = smooth;
Y = yellow, y = white;
R = ribbed, r = grooved

A cross was performed between two plants, **P** and **Q** of the same species; wherein, the plant **P** bears seeds that are homozygous recessive for grooved, homozygous dominant for long trait, and heterozygous for wrinkled texture and yellow colour. The plant **Q** bears seeds that are homozygous recessive for short and smooth traits, homozygous dominant for yellow colour and ribbed trait. Given that there are no influencing factors, state the resulting phenotype of the offspring for this cross.

Ans ✗ 1.
The seeds of half the plants would be long, smooth, yellow and grooved

✗ 2.
The seeds of half the plants would be long, wrinkled, white and ribbed

✗ 3.
The seeds of all the plants would be long, wrinkled, yellow and ribbed

✔ 4.
The seeds of half the plants would be long, wrinkled, yellow and ribbed

Q.5 Phylogenetic relationship among plants (**P**, **Q**, **R**, **S**) based on their shared characters is shown in the cladogram below.
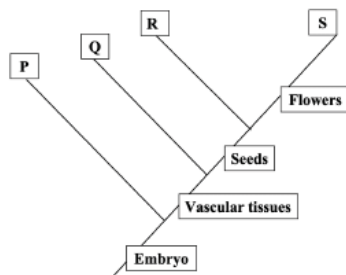
Identify the plants **P**, **Q**, **R** and **S** in the correct order.

Ans ✗ 1. **P**-Ferns, **Q**-Pines, **R**-Lilies, **S**-Liverworts

✔ 2. **P**-Liverworts, **Q**-Ferns, **R**-Pines, **S**-Lilies

✗ 3. **P**-Liverworts, **Q**-Ferns, **R**-Lilies, **S**-Pines

✗ 4. **P**-Pines, **Q**- Ferns, **R**-Liverworts, **S**-Lilies

Chosen Option : **2**

Marks : **3.00**

Q.6 Radioisotopes are frequently used in the study of cellular processes. A culture of *Escherichia coli* is grown at 37^oC in a minimal medium containing radioactive phosphorous. At the end of 48 hours, the amount of radioactivity expected in equimolar quantities of the following macromolecules is

Ans

✖ 1. RNA > Enzymes > Phospholipids

✔ 2. RNA > Phospholipids > Enzymes

✖ 3. Enzymes > RNA > Phospholipids

✖ 4. Phospholipids > Enzymes > RNA

Question Type : **MCQ**

Question ID : **4941032037**

Status : **Answered**

Chosen Option : **2**

Marks : **3.00**

Q.7 The haemocytometer is a thickened glass slide with small chamber of grids cut into the glass and is used to count cells. Each chamber has a fixed volume and is etched into nine large squares (see figure, **P** to **X**), each measuring 1 mm × 1 mm and 0.1 mm deep. Each large corner squares (**P**, **R**, **V** and **X**) contain 16 small squares. With a coverslip in place, each of these small squares represents a volume of 0.1 mm^3 (1.0 mm^2 area × 0.1 mm depth) or 10^{-4} cm^3. The number of cells counted in 4 large corner squares was 400, with the conversion factor as 1000.
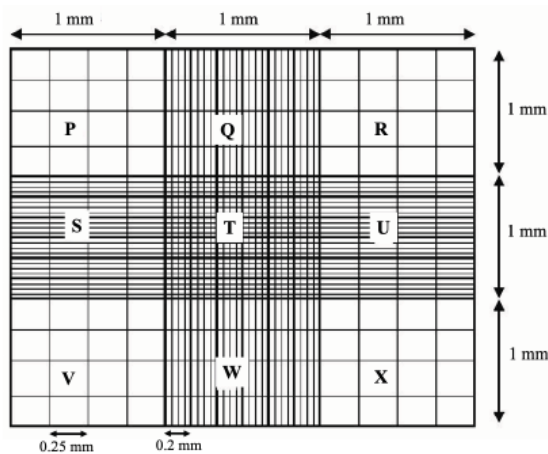
$$\text{Number of cells per ml} = \frac{\text{Number of cells counted}}{\text{Large squares counted}} \times \text{Dilution factor}$$

Given this information, calculate the total number of cells suspended in a volume of 5 ml, considering that the cells were diluted 1:2 before counting.

Ans

✖ 1. 2×10^5

✖ 2. 2×10^2

✖ 3. 5×10^4

✔ 4. 1×10^6

Question Type : **MCQ**

Question ID : **4941032034**

Status : **Answered**

Chosen Option : **1**

Marks : **-1.00**

Q.8 A scientist performed enzyme kinetics and obtained velocity **v** as a function of substrate concentration [**S**] and the values are given in the table below.

S (μMolar)	v (μ/min)	S (μMolar)	v (μ/min)
50	10.2	400	62.5
100	19.1	800	75.3
150	31.2	1000	76.2
200	38.1	1300	76.3
300	55.4	1600	77.2

The K_m of the substrate could be

Ans ✔ 1. 200

✗ 2. 77.2

✗ 3. 800

✗ 4. 38.1

> Question Type : **MCQ**
> Question ID : **4941032033**
> Status : **Answered**
> Chosen Option : **1**
> Marks : **3.00**

Q.9 Which among the following statements are correct?
(i) The quantum yield of photosynthesis decreases with increase in temperature in C3 plants, as compared to C4 plants.
(ii) The first stable product in C3 pathway is phosphoglycerate, whereas in C4 pathway it is oxaloacetate.
(iii) C3 pathway is present only in C3 plants and C4 pathway is present in all plants.
(iv) The rate of photorespiration is very high in C4 plants and very low in C3 plants.

Ans ✗ 1. (iii) and (iv)

✔ 2. (i) and (ii)

✗ 3. (ii) and (iv)

✗ 4. (ii) (iii) and (iv)

> Question Type : **MCQ**
> Question ID : **4941032030**
> Status : **Answered**
> Chosen Option : **2**
> Marks : **3.00**

Q.10 Select the option containing the correct matched pairs.

Column I	Column II
1. Helper T cells	a. May down-regulate or dampen parts of the immune response.
2. Suppressor T cells	b. Are programmed to recognise the reappearance of the original invading antigen.
3. Phagocytes	c. Differentiate into plasma cells that secrete specific antibodies.
4. Memory T cells	d. Ingest microbes or any foreign particulate matter; include neutrophils and macrophages.
5. B cells	e. Secrete cytokines as co-stimulators.

Ans ✗ 1. 1a, 2e, 3d, 4c, 5b

✗ 2. 1e, 2c, 3d, 4a, 5b

✔ 3. 1e, 2a, 3d, 4b, 5c

✗ 4. 1a, 2e, 3d, 4b, 5c

Q.11 A small viral peptide can insert its 6 amino acids (represented as a barrel) into the lipid bilayer as depicted in the figure given below.
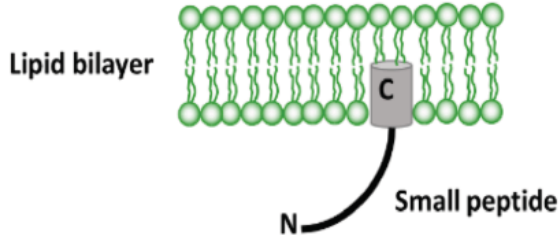
The table depicts the different properties of amino acids.

	Properties		
	Polar and uncharged	Polar and charged	Non-polar and hydrophobic
Amino Acids	Gly	Asp	Ala
	Ser	Glu	Val
	Thr	Lys	Leu
	Cys	Arg	Ile
	Asn	His	Pro
	Gln	—	Met
	Tyr	—	Phe
	—	—	Trp

The best suitable sequence that represents the barrel part is

Ans   ✗ 1. -Glu-Asp-Glu-Glu-Glu-Asp-COOH

✓ 2. -Ala-Leu-Ile-Leu-Leu-Ala-COOH

✗ 3. -Met-Gln-Asp-Asn-Gly-Asp-COOH

✗ 4. -Lys-Arg-Arg-Arg-Lys-Arg-COOH

Q.12 Proteins **P1** and **P2** bind to each other to form a complex. This complex has a high binding affinity to a specific element on the promoter sequence of a gene **X**, thus transcribing it. The product of gene **X** is responsible for the accumulation of red pigment in some plants. Under drought stress, another protein **P3** binds to **P2** and prevents its binding to **P1** and the plants appear pale. The following table depicts a representation of phenotypes of wild-type and mutant plants.

Condition \ Plant	Wild-type	Mutant-1	Mutant-2	Mutant-3
Water sufficiency	Red	Pale	Red	Pale
Drought	Pale	Pale	Red	Pale

Choose the correct statement(s).

Ans   ✓ 1.

Mutant-3 has mutation in gene coding for protein **P1** or protein **P2**.

✗ 2. Mutant-2 has mutation in genes coding for either protein **P1** or protein **P3**.

✓ 3. Mutant-2 has mutation in gene coding for protein **P3**.

✗ 4. Mutant-1 has mutation in gene coding for protein **P3**.

Question Type : **MSQ**
Question ID : **4941032040**
Status : **Answered**
Chosen Option : **1,3**
Marks : **4.00**

Q.13 Following is the sequence of a gene that produces peptide 'P' and has a promoter sequence in the 5' upstream region of the sense strand and not in that of the complementary strand.

Sense strand -

5' ATGCCCTGCACTGCAGGGCAT 3'

Complementary strand -

3' TACGGGACGTCACGTCCCGTA 5'

If Adenine is replaced with Thymine, and Guanine is replaced with Cytosine and vice-versa in both the DNA strands, then

Ans

✗ 1. Chargaff's rule will not hold true in this case.

✗ 2. The reading frame of the sequence is completely altered.

✓ 3. Chargaff's rule will hold true in this case.

✓ 4. Transcribing complementary strand from 3' to 5' will not give the peptide '**P**'.

Question Type : **MSQ**
Question ID : **4941032042**
Status : **Answered**
Chosen Option : **3**
Marks : **0.00**

Q.14 DNA $C_o t$ analysis is based upon the principles of DNA renaturation kinetics. The rate at which heat-denatured DNA sequences in solution will renature is dependent on DNA concentration, re-association temperature, cation concentration, and viscosity (usually not a factor if the DNA is free of contaminants). Upon heat-denaturation of an entire genomic DNA, the rate at which a particular sequence will re-associate in a given buffer solution is proportional to the number of times the sequence is found in the genome. Given enough time, nearly all of the DNA in a heat-denatured sample will re-associate. Highly repetitive, moderately repetitive and non-repetitive are the three types of DNA sequences found normally in all genomes giving them different levels of complexity. Typical $C_o t$ curves (see graph) were obtained for genomic DNA from three organisms (**P**, **Q** and **R**).
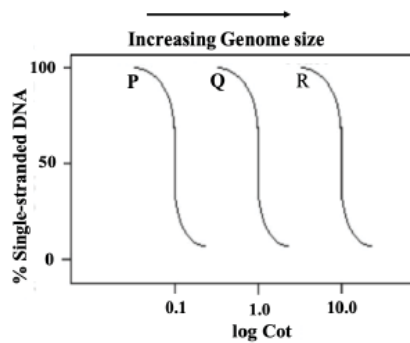
Based on this information, select the correct option(s) from the following.

Ans ✔ 1.

Genomic DNA of organism **P** is relatively less complex as compared to **Q** and **R**.

✔ 2.

Genomic DNA of organism **R** is relatively more complex that those of **P** and **Q**.

✘ 3.

Genomic DNA of organism **Q** is relatively more complex than that of **R**.

✘ 4.

Genomic DNA of organism **P** is relatively more complex than that of **R**.

Question Type :	**MSQ**
Question ID :	**4941032043**
Status :	**Answered**
Chosen Option :	**1**
Marks :	**0.00**

Q.15 Consider that plant species **P** is more efficient than plant species **Q** in nutrient uptake, but plant **Q** is a better seed disperser. In this example, the resource under competition is nutrient; but, nutrient acquisition is related to availability. If a disturbance opens up new space for colonization, plant **Q** is expected to arrive first and maintain its presence in the community until plant **P** arrives and begins competing with plant **Q**. Eventually, plant **P** will outcompete plant **Q**, because plant **P** is more efficient in nutrient acquisition and grows faster. With an increasing plant **P** population, the plant **Q** population will decline, and given enough time, has a possibility of shrinking in number in the present habitat. The way(s) of preventing the declining numbers of plant **Q** could be

Ans ✔ 1.

Intermediate local disturbances such as uncontrolled harvesting of plant **P** for commercial gains.

✔ 2. Sudden and specific infection of plant **P** by a fungus.

✘ 3.

Improved seed dispersal strategies by plant **P** in successive generations of plants.

✘ 4. Producing compounds which inhibit the growth of plant **Q**.

Question Type :	**MSQ**
Question ID :	**4941032041**
Status :	**Answered**
Chosen Option :	**1,2**
Marks :	**4.00**

Section : **Chemistry**

Q.1 In H atom, the electron is bound by Coulomb interaction and its three quantum numbers n, l, m are related as $n=1, 2, 3, 4,...; l = 0, 1, 2,...n\text{-}1; m=-l, -(l-1), ..0.., (l-1), l$. The spin quantum number $s=1/2$ and $-1/2$. Thus, the maximum number of electrons that can occupy the first four shells ($n = 1, 2, 3, 4$) are 2, 8, 18, 32, respectively. In artificial atoms (atomic clusters), where the electrons are bound by spherical harmonic oscillator potential, $n=0,1, 2, 3, 4,..$ with $l=0, 2, 4, 6,..n$, for even n, and $l=1, 3, 5, 7,..n$, for odd n. The possible values of m and s remain the same as in the case of H atom. The filled shell configuration for this system for filling up to $n=1, 2, 3$ and 4 will respectively correspond to the electron numbers

Ans ✅ 1. 8, 20, 40, 70

❌ 2. 6, 18, 38, 68

❌ 3. 6, 12, 20, 30

❌ 4. 2, 8, 18, 32

Question Type : **MCQ**
Question ID : **4941032050**
Status : **Answered**
Chosen Option : **3**
Marks : **-1.00**

Q.2 A compound is formed by two elements **X** and **Y**. Atoms of element **Y** form hexagonal close packing (hcp) lattice and those of the elements **X** occupy $(2/3)^{rd}$ of tetrahedral voids. The formula of the compound formed by the elements **X** and **Y** is

Ans ❌ 1. X_2Y_3

✅ 2. X_4Y_3

❌ 3. X_3Y_4

❌ 4. X_3Y_2

Question Type : **MCQ**
Question ID : **4941032047**
Status : **Answered**
Chosen Option : **2**
Marks : **3.00**

Q.3 Phosphorous forms different oxyacids such as, hypophosphorous acid (H_3PO_2), orthophosphorous acid (H_3PO_3) and orthophosphoric acid (H_3PO_4). Orthophosphorous acid on heating forms orthophosphoric acid, which on heating first forms pyrophosphoric acid ($H_4P_2O_7$) and on further heating forms polyphosphoric acid. The correct statement is

Ans ❌ 1. All oxyacids of phosphorous act as oxidising agents.

❌ 2. Polyphosphoric acid contains repeating PO_3 units.

❌ 3.

The basicities of orthophosphorous and orthophosphoric acids are the same.

✅ 4.

Heating of orthophosphorous acid is a disproportionation reaction.

Question Type : **MCQ**
Question ID : **4941032048**
Status : **Answered**
Chosen Option : **4**
Marks : **3.00**

Q.4 Two vessels X and Y contain aqueous solutions of a weak acid HA and its salt NaA, respectively. The following two equilibria $HA + H_2O \rightleftharpoons H_3O^+ + A^-$ and $A^- + H_2O \rightleftharpoons HA + OH^-$, exist in vessels X and Y, respectively. At equilibrium (at a given temperature T), the concentrations of HA, H_3O^+ and A^- in vessel X are C_1, C_2 and C_3, respectively, while that of A^-, HA and OH^- in vessel Y, are C_4, C_5 and C_6, respectively. Let the quantity $(C_2.C_3.C_5.C_6)/(C_1.C_4)$ be denoted by Q. The correct plot (ln Q vs 1/T) is

Ans

✗ 1.

✗ 2.

✗ 3.

✔ 4.
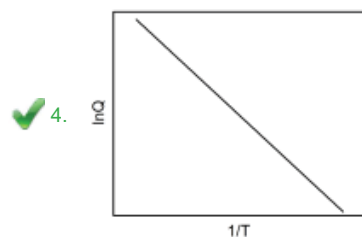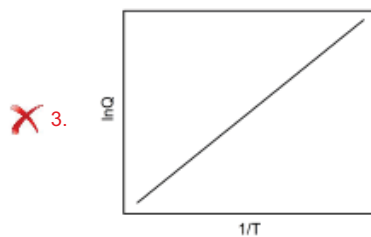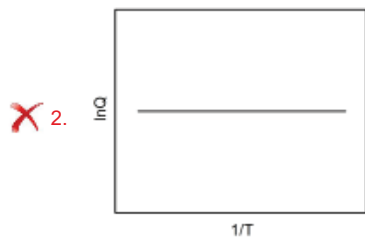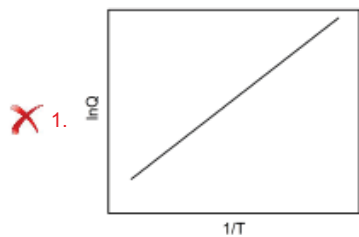
Question Type : **MCQ**
Question ID : **4941032051**
Status : **Answered**
Chosen Option : **1**
Marks : **-1.00**

Q.5 Consider two states, A and B, of a thermodynamic system. Let Path 1 represent a reversible process for going from A to B, while Path 2 represents an irreversible process for the same. Let the work done, heat change, and entropy change for the two processes be denoted by dw_{rev}, dq_{rev}, dS_{rev} and dw_{irrev}, dq_{irrev}, dS_{irrev}, respectively. It is observed that the relation $dw_{rev} < dw_{irrev}$ is obeyed. The correct statement is

Ans

✗ 1. $dS_{irrev} > dS_{rev}$

✗ 2. $dq_{rev} < dq_{irrev}$

✔ 3. $dw_{rev} + dq_{rev} = dw_{irrev} + dq_{irrev}$

✗ 4. $dw_{rev} + dq_{rev} < dw_{irrev} + dq_{irrev}$

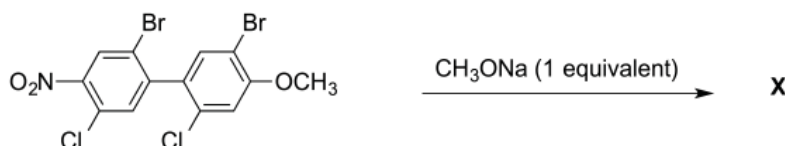| Question Type : **MCQ** |
|---|
| Question ID : **4941032053** |
| Status : **Answered** |

Chosen Option : **3**

Marks : **3.00**

Q.6 In an $S_N 2$ reaction, the group that leaves the substrate is called a leaving group. The ease of departure of leaving group is determined on the basis of acidity of the conjugate acid of the leaving group. The stronger the conjugate acid, the better is the leaving group. The compound having the best leaving group is

Ans

✗ 1. $CH_3CH_2CH_2CH_2OCOCH_3$

✔ 2. $CH_3CH_2CH_2CH_2OSO_2CH_3$

✗ 3. $CH_3CH_2CH_2CH_2OH$

✗ 4. $CH_3CH_2CH_2CH_2NH_2$

Question Type : **MCQ**

Question ID : **4941032046**

Status : **Answered**

Chosen Option : **2**

Marks : **3.00**

Q.7 The major substitution product (X) of the following reaction is

Ans

✗ 1.

✗ 2.

✔ 3.

✗ 4.

Question Type : **MCQ**

Question ID : **4941032044**

Status : **Answered**

Chosen Option : **3**

Marks : **3.00**

Q.8 When a mixture of NaCl, conc. H_2SO_4 and $K_2Cr_2O_7$ is heated, red vapours of compound **X** are formed. These vapours dissolve in aqueous NaOH to form a yellow solution, which upon treatment with $AgNO_3$ gives a red solid (**Y**). **X** and **Y** respectively are

Ans

✔ 1. CrO_2Cl_2 and Ag_2CrO_4

✗ 2. Na_2CrO_4 and $Ag_2Cr_2O_7$

✗ 3. CrO_2Cl_2 and $Ag_2Cr_2O_7$

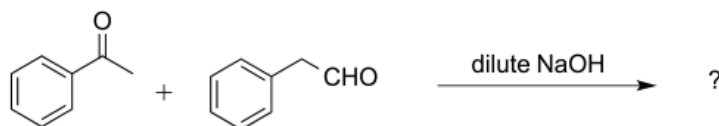✗ 4. Na_2CrO_4 and Ag_2CrO_4

Question Type : **MCQ**
Question ID : **4941032049**
Status : **Answered**
Chosen Option : **1**
Marks : **3.00**

Q.9 The following reaction leads to aldol products (olefins).

The number of theoretically possible products is

Ans

✗ 1. 6

✗ 2. 4

✔ 3. 8

✗ 4. 3

Question Type : **MCQ**
Question ID : **4941032045**
Status : **Answered**
Chosen Option : **2**
Marks : **-1.00**

Q.10 Consider two vessels X and Y, each of volume V, and at temperature T, connected through a tube fitted with a stop cock. Vessel X initially contains 1 mole of A(s), which establishes the equilibrium $A(s) \rightleftharpoons B(g)$ leading to the gas pressure P. In vessel Y there is vacuum. The stop cock is then opened and new equilibrium is allowed to be established at constant temperature. The pressure observed in both the vessels is P_{new}. The correct relationship is: (volume of the tube may be neglected)

Ans

✔ 1. $P_{new} = P$

✗ 2. $P_{new} = P/2$

✗ 3. $P_{new} = RT/V$

✗ 4. $P_{new} = RT/2V$

Question Type : **MCQ**
Question ID : **4941032052**
Status : **Answered**
Chosen Option : **1**
Marks : **3.00**

Q.11 Organometallic compounds are those compounds which contain a carbon-metal (C-M) bond. They react as nucleophilic reagents, where the carbon bonded to the metal is nucleophilic. Alkyl halides on reaction with some metals give the corresponding organometallic compounds. They undergo metal exchange reactions with appropriate metal halides. In such a reaction, organometallic compound containing less polar C-M bond is formed. Organometallic compounds containing ionic C-M bond are unstable and react further during the reaction. The correct statement(s) is/are

Ans

✗ 1.

Propyl sodium can be isolated by treating 1-bromopropane with sodium under normal conditions.

✔ 2. Ethyl lithium is more nucleophilic than triethyl aluminium.

✔ 3.

The reaction of propyl magnesium bromide with cadmium chloride gives dipropyl cadmium.

✔ 4.

After reacting 1-bromobutane with magnesium, the reactivity of the product is reversed as compared to that of 1-bromobutane.
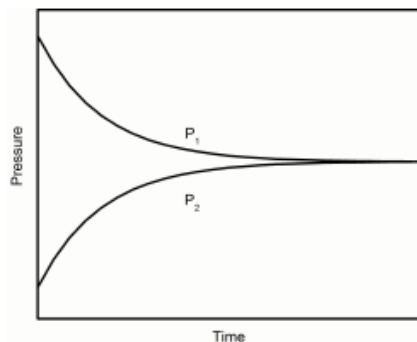
Question Type : **MSQ**
Question ID : **4941032054**
Status : **Answered**
Chosen Option : **2,3,4**
Marks : **4.00**

Q.12 A thermally insulated vessel is partitioned into two compartments by a fixed diathermal (heat conducting) wall and each compartment contains certain amount of ideal gas. The temperature, pressure, volume, number of moles, entropy of the gases in the first and second compartments are denoted by T_1, P_1, V_1, n_1, S_1 and T_2, P_2, V_2, n_2, S_2, respectively. Initially, $T_1 = 400$ K and $T_2 = 200$ K, $n_1 = n_2$, $V_2 = V_1$ and the system evolves in time till thermal equilibrium is reached. The correct figure(s) depicting this spontaneous process, can be described as
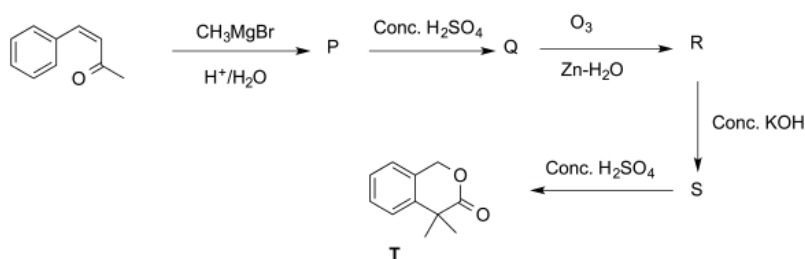
Ans

✔ 1.

✘ 2.

✔ 3.
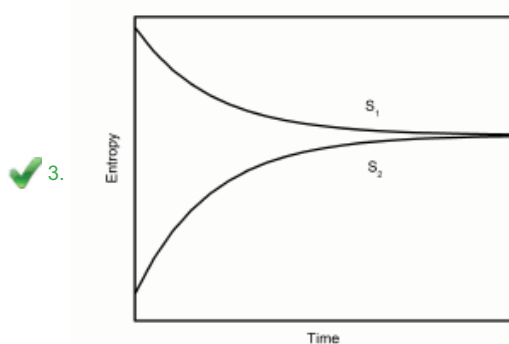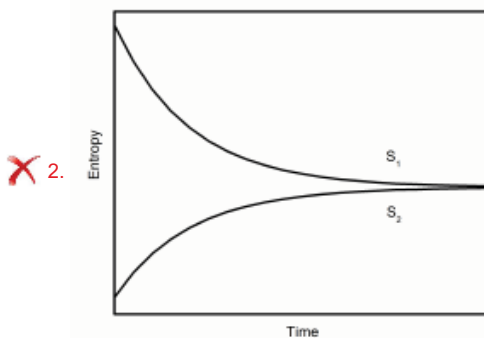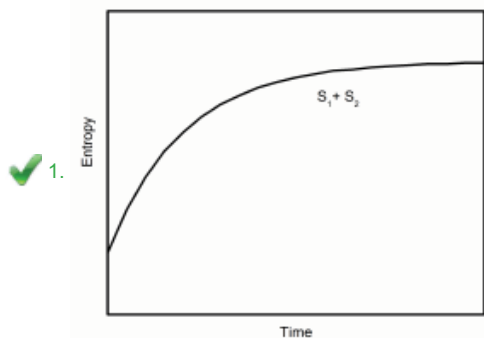
✔ 4.

Question Type : **MSQ**
Question ID : **4941032058**
Status : **Not Answered**
Chosen Option : **--**
Marks : **0.00**

Q.13 The correct statement(s) with respect to the following sequence of reactions is/are

Ans

✔ 1. **S** on treatment with $NaHCO_3$ gives effervescence.

✔ 2. **Q** decolorizes bromine water.

✔ 3.

Formation of **R** from **Q**, and **S** from **R** involve carbon-oxygen bond formation.

✔ 4. **T** dissolves in warm aq. KOH.

Question Type : **MSQ**
Question ID : **4941032055**
Status : **Answered**
Chosen Option : **1,2,3,4**
Marks : **4.00**

Q.14 Iron oxide can be reduced by CO and H_2. Blast furnace is historically important as it provided iron in reasonably pure form. In Blast furnace, coke and hot air is used with iron oxide. Syngas is manufactured by the reaction of carbonaceous matter with water at high temperature. It has application in Blast furnace. In context of this process, the correct statement(s) is/are

Ans

✘ 1. Use of syngas helps in reducing the slag.

✔ 2.

Syngas on reaction with water produces better reducing agent.

✘ 3.

Carbon itself acts as the main reducing agent in blast furnace.

✔ 4. Use of syngas eliminates the chances of pig iron formation.

Question Type : **MSQ**
Question ID : **4941032056**
Status : **Answered**

Chosen Option : **2,4**

Marks : **4.00**

Q.15 Metal ions in the fourth period are expected to show decrease in their ionic radii of the M^{2+} ions from Ca^{2+} to Zn^{2+}, due to the increase in the nuclear charge, as shown by the dotted line in the Figure given below. When they form octahedral complexes with weak field ligands, the expected regular decrease is not observed, as shown by the solid line in the Figure. The correct statement(s) is/are
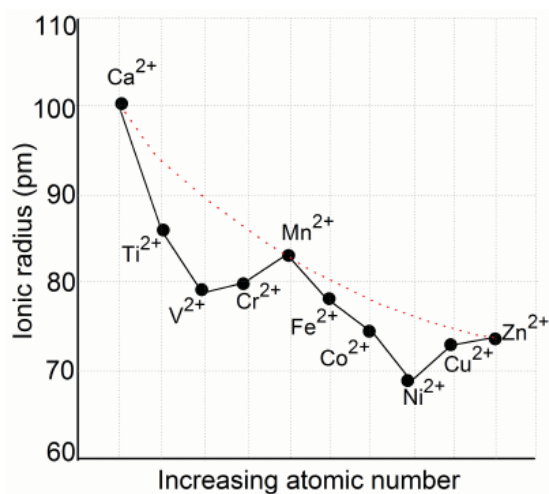
Ans ✖ 1.

The ionic radius of Cr^{3+} is more than V^{3+} in their respective weak field octahedral complexes.

✔ 2.

The heat of hydration of $[Cr(H_2O)_6]^{2+}(aq)$ is more than $[Ti(H_2O)_6]^{2+}(aq)$.

✔ 3.

The anomalous trend in the radius of Cr^{2+} as shown in the Figure is due to occupancy of electron in the e_g orbital of Cr^{2+}.

✖ 4.

When metal ions shown in above Figure form complexes with strong field ligands like CN^-, the anomalous trend in ionic radii starts from Fe^{2+}.

Question Type : **MSQ**

Question ID : **4941032057**

Status : **Answered**

Chosen Option : **2,3**

Marks : **4.00**

Section : **Mathematics**

Q.1 If x, y are positive real numbers such that $x \cdot [x] = 36$ and $y \cdot [y] = 71$, then $x + y$ equals

Ans ✖ 1. $\dfrac{115}{6}$

✔ 2. $\dfrac{119}{8}$

✖ 3. $\dfrac{115}{9}$

✖ 4. $\dfrac{117}{8}$

Question Type : **MCQ**

Question ID : **4941032067**

Status : **Answered**

Chosen Option : **2**

Marks : **3.00**

Q.2 Let ABC be a triangle with $4 \sin A = \sec B$ and $3 \tan A = \tan B$. Then the triangle ABC is

Ans ✗ 1. isosceles

✗ 2. equilateral

✔ 3. right-angled

✗ 4. obtuse-angled

Question Type : **MCQ**

Question ID : **4941032064**

Status : **Answered**

Chosen Option : **3**

Marks : **3.00**

Q.3 A six-faced unbiased die is thrown until a number greater than 4 appears. The probability that this occurs on the n-th throw, where n is an even integer, is

Ans ✗ 1. $\dfrac{1}{5}$

✗ 2. $\dfrac{1}{2}$

✗ 3. $\dfrac{2}{3}$

✔ 4. $\dfrac{2}{5}$

Question Type : **MCQ**

Question ID : **4941032060**

Status : **Not Answered**

Chosen Option : **--**

Marks : **0.00**

Q.4 The tangents at the extremities of the latus rectum of the parabola $y^2 = 4ax$ meet at

Ans ✗ 1. $(a, 0)$

✔ 2. $(-a, 0)$

✗ 3. $(0, 0)$

✗ 4. infinity

Question Type : **MCQ**

Question ID : **4941032065**

Status : **Answered**

Chosen Option : **1**

Marks : **-1.00**

Q.5 Let $f : (0, \infty) \to \mathbb{R}$ be a function defined as $f(x) = \dfrac{xe^{-x}}{1+x}$. Then

Ans ✗ 1. f is a strictly decreasing function on $(0, \infty)$

✗ 2. f is a surjective function

✗ 3. f is a strictly increasing function on $(0, \infty)$

✓ 4. there exists a unique $x_0 \in (0, \infty)$ such that $f(x_0)f''(x_0) < 0$

Question Type : **MCQ**
Question ID : **4941032062**
Status : **Not Answered**
Chosen Option : **--**
Marks : **0.00**

Q.6 Let $S = \{x \in \mathbb{C} : |x - 1| = 1\}$. If z is an element of S with argument $\frac{\pi}{6}$, then the argument of $z^2 - z$ is

Ans

✗ 1. $\dfrac{\pi}{6}$

✓ 2. $\dfrac{\pi}{2}$

✗ 3. $\dfrac{\pi}{3}$

✗ 4. $\dfrac{2\pi}{3}$

Question Type : **MCQ**
Question ID : **4941032063**
Status : **Not Answered**
Chosen Option : **--**
Marks : **0.00**

Q.7 A variable line in a plane passes through a fixed point and meets the coordinate axes at points A and B. Then the locus of the mid-point of AB is

Ans

✓ 1. a hyperbola

✗ 2. a parabola

✗ 3. a circle

✗ 4. an ellipse

Question Type : **MCQ**
Question ID : **4941032066**
Status : **Answered**
Chosen Option : **1**
Marks : **3.00**

Q.8 Let $n \geq 2019$ be odd and let $1 \leq a_1 < a_2 < \cdots < a_k \leq n$ be k integers. The least value of k, for which there exists a pair (i, j) with $1 \leq i < j \leq k$ and $a_j - a_i = a_1$, is

Ans

1. $\dfrac{n - 3}{2}$

2. $\dfrac{n - 1}{2}$

3. $\dfrac{n + 3}{2}$

4. $\dfrac{n + 1}{2}$

Note: For this question, discrepancy is found in question/answer. So, This question is ignored for all candidates.

Question Type : **MCQ**

Question ID : **4941032061**

Status : **Not Answered**

Chosen Option : **--**

Marks : **0.00**

Q.9 A positive integer k is *perfect* if the sum of its positive divisors equals $2k$. If n is a perfect number, then the sum of the reciprocal of its positive divisors

Ans

✗ 1. varies with n

✓ 2. is 2

✗ 3. is 1

✗ 4. is greater than $n/2$

Question Type : **MCQ**

Question ID : **4941032059**

Status : **Not Answered**

Chosen Option : **--**

Marks : **0.00**

Q.10 The y-intercepts of three parallel lines are $2, 3, 4$, and the sum of their x-intercepts is 36. Then the slope of these three parallel lines is

Ans

✓ 1. $-\dfrac{1}{4}$

✗ 2. $-\dfrac{1}{2}$

✗ 3. $-\dfrac{1}{3}$

✗ 4. $-\dfrac{1}{6}$

Question Type : **MCQ**

Question ID : **4941032068**

Status : **Answered**

Chosen Option : **1**

Marks : **3.00**

Q.11 Let $f : \mathbb{R} \longrightarrow \mathbb{R}$ be a function given by $f(x) = \max\{1 - x, 1 + x, 2\}$. Then

Ans

✓ 1. f is strictly increasing in the interval $(1, \infty)$

✓ 2. f is continuous everywhere

✗ 3. f is differentiable everywhere

✗ 4.

the minimum value of f is attained only at a finite number of points

Question Type : **MSQ**

Question ID : **4941032073**

Status : **Answered**

Chosen Option : **1,2**

Marks : **4.00**

Q.12 For a 2×2 non-zero matrix P with real entries, let s_k be the sum of the diagonal entries of P^k for any positive integer k. Then

Ans

✓ 1. P is a singular matrix if $s_k = 0$ for every $k \geq 1$

✔ 2.

$s_{2m} > 0$ for every positive integer $m \geq 2$ if P is non-singular and $s_1 = 0$

✔ 3. $s_{2019} = 0$ if $s_1 = 0$

✘ 4.

there exists a 2×2 matrix Q such that $PQ - QP = I$, where I is the 2×2 identity matrix

> Question Type : **MSQ**
> Question ID : **4941032071**
> Status : **Not Answered**
> Chosen Option : **--**
> Marks : **0.00**

Q.13 Let $f : [0, 1] \to [0, 1]$ be a non-constant continuous function different from the identity function. Then

Ans ✔ 1. the graph of f meets the line $y = x$ at least once

✔ 2.

there exists $x_0 \in [0, 1/2]$ such that $f(x_0) = f(x_0 + 1/2)$ if $f(0) = f(1)$

✘ 3. the set $\{x \in [0, 1] : f(f(x)) = x\}$ is empty

✔ 4. there exists $y_0 \in [0, 1]$ such that $\int_0^{y_0} f(t)dt = \int_{y_0}^1 f(t)dt$

> Question Type : **MSQ**
> Question ID : **4941032070**
> Status : **Not Answered**
> Chosen Option : **--**
> Marks : **0.00**

Q.14 For two vectors $\vec{u}$ and $\vec{v}$, define

$$\vec{u} * \vec{v} = \vec{u} \times (\vec{u} \times \vec{v}) + \vec{v} \times (\vec{v} \times \vec{u}).$$

Then

Ans ✘ 1.

$\vec{u} * (\vec{u} + \vec{v}) = \vec{u} * \vec{v}$, for any two arbitrary vectors $\vec{u}$ and $\vec{v}$

✔ 2. $\vec{u} * \vec{v} = \vec{v} * \vec{u}$ and $\vec{u} * \vec{u} = \vec{0}$

✔ 3.

the angle between the vectors $\vec{u} - \vec{v}$ and $\vec{u} * \vec{v}$ is $90°$, where $\vec{u}$ and $\vec{v}$ are two distinct non-zero vectors

✘ 4. $\vec{u} * \vec{v} \neq \vec{0}$ if $\vec{u}$ and $\vec{v}$ are distinct non-zero vectors

> Question Type : **MSQ**
> Question ID : **4941032069**
> Status : **Not Answered**
> Chosen Option : **--**
> Marks : **0.00**

Q.15 Let $n \geq 2$ be an integer and $X = \{1, \ldots, n\}$. Define

$$\Sigma = \{\sigma : \sigma \text{ is a bijection of } X \text{ and } |\sigma(k) - k| \leq 1 \text{ for all } k \in X\}$$

and for any $\sigma \in \Sigma$, $Y_\sigma = \{m \in X : \sigma(m) = m\}$. Then

Ans ✔ 1. number of elements of Σ is 1 if Y_σ is empty for some $\sigma \in \Sigma$

✅ 2. for every $\sigma \in \Sigma$, $\sigma(\sigma(k)) = k$ for all $k \in X$

✅ 3. n is odd implies Y_σ is non-empty for every $\sigma \in \Sigma$

✅ 4.

n is even implies number of elements of Y_σ is even for every $\sigma \in \Sigma$

Question Type :	**MSQ**
Question ID :	**4941032072**
Status :	**Not Answered**
Chosen Option :	**--**
Marks :	**0.00**

Section : **Physics**

Q.1 The compressor of a Carnot refrigerator consumes 5 J of energy per cycle. The hot reservoir is at temperature 27°C and the amount of energy released to it per cycle is 25 J. Then the lowest possible temperature attained by the cold reservoir will be close to

Ans ❌ 1. $-43°$C

❌ 2. $7°$C

✅ 3. $-33°$C

❌ 4. $22°$C

Question Type :	**MCQ**
Question ID :	**4941032077**
Status :	**Answered**
Chosen Option :	**3**
Marks :	**3.00**

Q.2 A spring, fixed at one end, is connected to a steel wire of length L. The other end of the steel wire is connected to an AC source providing a sinusoidal signal of fixed frequency f. This stretches the spring and produces standing waves. The spring stretched by 18 cm produces a standing wave with four antinodes in the steel wire. The stretch of the spring which will produce a standing wave of three antinodes is

Ans ❌ 1. 16 cm

✅ 2. 32 cm

❌ 3. 24 cm

❌ 4. 40 cm

Question Type :	**MCQ**
Question ID :	**4941032080**
Status :	**Answered**
Chosen Option :	**2**
Marks :	**3.00**

Q.3 A torus with mean radius r_0 and uniform cross sectional area $a \times a$ carries a coil with N turns wound uniformly around it. The medium in the torus is air. A straight, long wire carrying current I passes through the centre of the torus. The wire is perpendicular to the plane of the torus. Assuming $r_0 \gg a$, the mutual inductance between the coil and the wire is

Ans ❌ 1. $\dfrac{\mu_0 r_0 \left(1 + a^2/r_0^2\right)}{4\pi} N$

❌ 2. $\dfrac{\mu_0 r_0 \left(1 + r_0^2/a^2\right)}{4\pi} N$

✓ 3. $\dfrac{\mu_0 a^2}{2\pi r_0} N$

✗ 4. $\dfrac{\mu_0 a^2}{2\sqrt{2}\pi r_0} N$

Question Type : **MCQ**
Question ID : **4941032083**
Status : **Answered**
Chosen Option : **3**
Marks : **3.00**

Q.4

A block of mass M at rest on the floor is attached to a ball of mass $M/2$ via a light inextensible string of length L which passes over a light small frictionless pulley. The pulley is at a height of $0.6L$ from the floor. The ball is raised to a height of $L/6$ and released (see figure). The speed of the block at the instant the string gets taut (not slack) will be
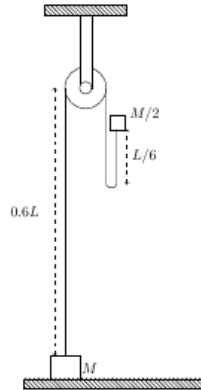
Ans

✓ 1. $\dfrac{\sqrt{2gL/3}}{3}$

✗ 2. $\dfrac{\sqrt{gL/6}}{3}$

✗ 3. $\dfrac{\sqrt{4gL}}{3}$

✗ 4. $\dfrac{\sqrt{1.2gL}}{3}$

Question Type : **MCQ**
Question ID : **4941032075**
Status : **Answered**
Chosen Option : **1**
Marks : **3.00**

Q.5 The voltage $V(t)$ across a capacitor of capacitance C discharging through a resistance R is given by $V(t) = V_0 e^{-t/RC}$. The initial voltage V_0 is 10.00 ± 0.02 V, $R = 100.0 \pm 0.1\%$ MΩ and $C = 1.00$ μF. The circuit is closed and subsequently disconnected after 100 ± 1 seconds. The final voltage is best represented as

Ans

✗ 1. 2.71 ± 0.01 V.

✗ 2. 3.67 ± 0.003 V.

✓ 3. 3.67 ± 0.05 V.

✗ 4. 3.67 ± 0.37 V.

Question Type : **MCQ**
Question ID : **4941032081**
Status : **Answered**
Chosen Option : **3**
Marks : **3.00**

Q.6 An iron slab and a copper slab having rectangular cross-sections and identical dimensions are welded together end to end. The outer ends of iron and copper slabs are held at 0°C and 100°C respectively. The thermal conductivities of iron and copper are 80 W·m^{-1}·K^{-1} and 400 W·m^{-1}·K^{-1}, respectively. Then, ignoring convective and radiative losses, the temperature of the junction is close to

Ans ✗ 1. 17°C

✔ 2. 83°C

✗ 3. 50°C

✗ 4. 66°C

Question Type : **MCQ**
Question ID : **4941032076**
Status : **Answered**
Chosen Option : **2**
Marks : **3.00**

Q.7 White light with uniform intensity across the visible wavelength range of 400 nm to 800 nm is incident almost perpendicularly from above onto a horizontal liquid film of refractive index 1.25 and of thickness 300 nm. The medium on both sides of the film is air. The wavelength of light reflected by the film which appears brightest to an observer seeing it from the top is close to

Ans ✗ 1. 600 nm

✔ 2. 500 nm

✗ 3. 300 nm

✗ 4. 750 nm

Question Type : **MCQ**
Question ID : **4941032079**
Status : **Answered**
Chosen Option : **2**
Marks : **3.00**

Q.8 Consider a set of 12 equal charges ($+q$ each), arranged to form two concentric regular hexagons in the xy-plane, centred at origin. The edges of the two hexagons have lengths a and $2a$ respectively. They are arranged in such a way that two vertices of each one of them are on the y-axis. Suppose that the charges from the vertices at $(0, 2a)$ and $(0, -a)$ are removed. Then, the magnitude of the electric field produced by the resulting configuration at the origin is

Ans ✗ 1. $\dfrac{3}{8\pi\epsilon_o a^2} q$

✔ 2. $\dfrac{3}{16\pi\epsilon_o a^2} q$

✗ 3. $\dfrac{5}{16\pi\epsilon_o a^2} q$

✗ 4. $\dfrac{5}{8\pi\epsilon_o a^2} q$

Question Type : **MCQ**
Question ID : **4941032082**
Status : **Answered**
Chosen Option : **2**
Marks : **3.00**

Q.9 C^{14} has a half life of 5730 years and its abundance in the atmosphere is 1 in 10^{12} carbon atoms. A fresh sample of 0.001 mole of CO_2 collected from the atmosphere records a decay of 1700 C^{14} atoms over a week. A large piece of old wood is burnt and 0.001 mole of CO_2 collected from it records a decay of 430 C^{14} atoms over a week. Then the age of the wood is close to

Ans

✗ 1. 8600 years.

✓ 2. 11500 years.

✗ 3. 2900 years.

✗ 4. 1440 years.

Question Type : **MCQ**
Question ID : **4941032078**
Status : **Answered**
Chosen Option : **2**
Marks : **3.00**

Q.10 A long container has a square base of side L. The height to which water should be filled so that the force on one of its side surface is the same as that at its bottom is (ignore atmospheric pressure)

Ans

✗ 1. $L/4$

✗ 2. L

✗ 3. $L/2$

✓ 4. $2L$

Question Type : **MCQ**
Question ID : **4941032074**
Status : **Answered**
Chosen Option : **4**
Marks : **3.00**

Q.11 The speed, frequency of revolution and the radius of the electron in the nth orbital in the Bohr model ($Z = 1$) are denoted by v_n, f_n^{rev} and r_n, respectively. Let $f(n)$ be the frequency of the photon when the electron makes a transition from the nth orbital to the $(n-1)^{th}$ orbital. Then,

Ans

✗ 1. $f_n^{rev} \propto 1/n^2$

✓ 2. $v_n \propto 1/n$

✓ 3. $r_n \propto n^2$

✓ 4. For large $n(\gg 1)$, $f(n) = f_n^{rev}$

Question Type : **MSQ**
Question ID : **4941032086**
Status : **Answered**
Chosen Option : **2,3,4**
Marks : **4.00**

Q.12 A magnet of weight 2 N is placed on a non-magnetic horizontal table of weight 20 N. Another magnet of identical geometry is kept on the underside of the table top and aligned exactly with the upper magnet but with opposite polarity. The magnetic force on the lower magnet due to the upper one is thrice the weight of the lower magnet. If this magnetic force is 6 N, then

Ans

✗ 1.
the reaction force on the table due to the earth's gravitational field is 20 N.

✔ 2.

the normal reaction of the table on the upper magnet is 8 N.

✔ 3. the lower magnet will not fall.

✔ 4. the normal reaction of the table on the lower magnet is 4 N.

> Question Type : **MSQ**
> Question ID : **4941032084**
> Status : **Answered**
> Chosen Option : **2,3,4**
> Marks : **4.00**

Q.13 A horizontal cylinder closed at one end contains an ideal gas which is compressed by a tight-fitting and frictionless piston. The piston is connected to the other closed end of the cylinder via a spring with spring constant k. The piston is of cross-sectional area A and mass M. In equilibrium, the chamber containing the gas has pressure P and length L while the spring is compressed by l. Let the the piston be displaced by d ($\ll L$) towards the vacuum region, and released. Choose the correct statement(s) regarding the oscillations of the piston by assuming all processes are isothermal.

Ans ✘ 1.

The oscillations of the piston are periodic but not simple harmonic.

✔ 2. $l = PA/k$.

✘ 3. The net work done in one complete oscillation is $2kd$.

✔ 4. Both large k and large P imply small time period.

> Question Type : **MSQ**
> Question ID : **4941032085**
> Status : **Not Answered**
> Chosen Option : **--**
> Marks : **0.00**

Q.14 Consider a closed system of three charged particles with charges $3e$, e and $7e$ respectively, where e is the electronic charge. Their corresponding masses are $6m$, $2m$ and $14m$ where m is the mass of electron. The particles maybe moving in an arbitrary way. Then,

Ans ✔ 1. the cyclotron frequencies of all the particles are same.

✘ 2.

the dipole moment of the system is independent of the choice of the origin of coordinates.

✔ 3.

the magnetic moment of the system is proportional to the total angular momentum.

✔ 4.

the second time derivative of the dipole moment vector is zero for all times.

> Question Type : **MSQ**
> Question ID : **4941032088**
> Status : **Answered**
> Chosen Option : **1,2,3**
> Marks : **0.00**

Q.15 A square object of size 1 cm × 1 cm consists of two dark spots which are 4 μm apart. The object is viewed using a compound microscope of numerical aperture 0.25 with light of wavelength 500 nm. The objective lens has a focal length of 1.8 cm and the eyepiece lens has a focal length of 6 cm. The distance between the objective and eyepiece lens is 24 cm. Then,

Ans ✔ 1.

the object has to be placed 2 cm from the objective lens so that a sharp focused image is seen by relaxed eyes.

✘ 2.

If the objective is replaced with a lens with higher magnification, the distance between the objective and eyepiece has to be increased to see sharp focused image by relaxed eyes.

✘ 3.

the size of the image will appear to be approximately 9 cm × 9 cm.

✔ 4.

the microscope is able to resolve the two dark spots in the object.

Question Type :	**MSQ**
Question ID :	**4941032087**
Status :	**Not Answered**
Chosen Option :	**--**
Marks :	**0.00**