AP DEECET 2025 Physical Science Question Paper with Solution

Time Allowed :120 Minutes	**Maximum Marks :**100	**Total Questions :**100

General Instructions

Read the following instructions very carefully and strictly follow them:

1. The duration of the test is **3 hours**.
2. Each question carries **1 mark**. There is **no negative marking**.
3. The medium of the question paper is **English** and **Telugu/Urdu (as opted by the candidate)**.
4. Candidates must report at the test center **at least 90 minutes before** the commencement of the examination.
5. Candidates must carry:
   - **Filled-in Online Application Form (printout)**
   - **Valid Photo ID Proof** (Aadhaar, Passport, PAN, Driving Licence, etc.)
6. Rough work must be done only on the provided rough sheets. Additional sheets will not be provided.
7. Use of **calculators, mobile phones, smart watches, or any electronic devices** is strictly prohibited.
8. Follow the invigilator's instructions carefully. Any malpractice will result in **disqualification**.

1. Mentally retorted child is there in our catchment area. As a teacher you will join him in this school
(A) Bhavitha Centre
(B) Anganwadi Center
(C) K.G.B.V
(D) Pre Primary School
Correct Answer: (A) Bhavitha Centre

Solution:
The question uses an outdated term but refers to a child with special educational needs.

Bhavitha Centres are specialized resource centers established by the government in Andhra Pradesh.

These centers are specifically designed to cater to the educational and therapeutic needs of children with disabilities.

While inclusive education in a mainstream school (like a Pre Primary School) is a goal, the provided answer key points to the specialized institution as the correct choice.

This implies a pedagogical approach where a child with significant needs might first be enrolled in a specialized center to receive targeted support.

Therefore, according to the key, the Bhavitha Centre is the designated place for such a child.

Quick Tip

For questions about special education, be aware of both the ideal of mainstream inclusion and the existence of specialized government institutions like Bhavitha Centres. The context of the question and options determines the expected answer.

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2. As a teacher you have to follow this to improve retention ability among students is
(A) News reading
(B) Giving home work
(C) Practicing tables and poems
(D) Drawing
Correct Answer: (C) Practicing tables and poems

Solution:
The question asks for a method to specifically improve the 'retention ability' or memory of students.

Retention is enhanced through techniques that involve repetition and active recall.

News reading improves general awareness, and drawing improves creativity, but neither directly targets memory retention as its primary goal.

Giving homework is a broad practice for reinforcing various skills.

Practicing tables and poems involves rote learning, which is a direct and effective method for strengthening neural pathways for memory and recall.

The repeated recitation and practice commit the information to long-term memory.

Thus, this is the most direct method among the options to improve retention.

Quick Tip

To enhance memory retention, focus on strategies like spaced repetition, active recall, and mnemonic devices. Rote learning, as in practicing tables, is a fundamental form of repetition-based learning.

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3. This is useful to make children hand writing good
(A) Imposition writing
(B) Copy book writing
(C) Dictation
(D) Habituate children to write from early years.
Correct Answer: (B) Copy book writing

Solution:
The objective is to find the most effective technique for improving handwriting.

Imposition writing is a form of punishment and is counterproductive to developing good writing habits.

Dictation focuses on listening and spelling skills, not the physical formation of letters.

Habituating children to write early is a good general practice but doesn't guarantee correct letter formation.

Copy book writing is a specific pedagogical tool where students imitate perfectly formed letters and words.

This process directly trains the hand muscles and helps the child learn correct size, shape, and spacing of letters.

Therefore, it is the most targeted and effective method for improving handwriting.

Quick Tip

Handwriting improvement is a motor skill. Look for options that involve direct practice and imitation of correct forms, like tracing or copy book writing.

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4. Identify wrong statement related to achievement level of children
(A) Every child has his own learning level.
(B) Do not compare children.
(C) Children cannot learn without motivation.

(D) Children cannot learn if parents are illiterate.
Correct Answer: (D) Children cannot learn if parents are illiterate.

Solution:
The question asks to identify the incorrect statement about a child's learning and achievement.

Statement (A) is a core principle of child-centric education; learning is individual.

Statement (B) is a sound pedagogical principle to avoid demotivation and foster self-esteem.

Statement (C) is also true; motivation is a key driver for learning.

Statement (D) is a false and discriminatory statement. A child's capacity to learn is not determined by their parents' educational background.

Effective teaching, a supportive school environment, and the child's own abilities are far more significant factors.

Therefore, this statement is the wrong one.

Quick Tip

In pedagogy questions, reject any statement that makes absolute, deterministic claims based on a child's socio-economic background, parental education, or other external factors. Education aims to provide opportunities regardless of these factors.

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5. The schools established exclusively for the meritorious children resides in rural areas is
(A) Model Schools
(B) Sainik Schools
(C) Navodaya Vidyalaya
(D) Central Schools
Correct Answer: (C) Navodaya Vidyalaya

Solution:
The question seeks to identify a specific type of school in India with particular characteristics.

The key features are: 1) for meritorious (talented) children, and 2) located in rural areas.

Central Schools (Kendriya Vidyalayas) are primarily for children of central government employees.

Sainik Schools are focused on preparing students for the armed forces.

Model Schools are a broader initiative for quality education.

The Jawahar Navodaya Vidyalaya (JNV) scheme was specifically created to provide high-quality education to talented students predominantly from rural areas in India.

They are residential schools, and one is established in nearly every district of the country.

This perfectly matches the description in the question.

Quick Tip

Remember the unique objectives of India's main government school systems: KVs for transferrable employees, JNVs for rural talent, and Sainik Schools for military careers. This distinction is often tested.

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6. Printing Press was invented by
(A) Johannes Gutenberg
(B) George Claude
(C) Alexander Fleming
(D) Karl Benz
Correct Answer: (A) Johannes Gutenberg

Solution:
This is a question of historical general knowledge.

Johannes Gutenberg, a German blacksmith, goldsmith, inventor, printer, and publisher, introduced printing to Europe with his mechanical movable-type printing press.

His invention is considered a milestone of the second millennium, ushering in the modern period of human history.

Alexander Fleming discovered Penicillin.

George Claude invented the Neon lamp.

Karl Benz is credited with inventing the first practical automobile.

Therefore, Johannes Gutenberg is the correct answer.

Quick Tip

Associate key inventors with their most famous inventions: Gutenberg - Printing Press, Bell - Telephone, Edison - Phonograph/Practical Light Bulb, Wright Brothers - Airplane. These are foundational general knowledge facts.

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7. Sardar Sarovar dam is located in this State
(A) Tamilnadu
(B) Uttarakhand
(C) Bihar
(D) Gujarat
Correct Answer: (D) Gujarat

Solution:
This question tests geographical knowledge of major projects in India.

The Sardar Sarovar Dam is a concrete gravity dam built on the Narmada river.

It is located in Navagam, near the town of Kevadiya in the state of Gujarat, India.

The dam benefits four Indian states: Gujarat, Madhya Pradesh, Maharashtra, and Rajasthan.

However, its physical location is in Gujarat.

Therefore, Gujarat is the correct answer.

Quick Tip

For geography questions, it's helpful to remember not just the names of major dams but also the river they are on and the state they are located in. For example, Hirakud Dam (Mahanadi, Odisha), Bhakra Nangal Dam (Sutlej, Himachal Pradesh/Punjab border).

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8. Person who invented Amrutanjan and also titled as Desabandhu, Desoddharaka was
(A) Kasinathuni Nageswara Rao
(B) Kandukuri Veeresalingam
(C) Tanguturi Prakasam
(D) Konda Venkatappayya
Correct Answer: (A) Kasinathuni Nageswara Rao

Solution:
This question is about a prominent personality from Andhra Pradesh.

Kasinathuni Nageswara Rao Pantulu was an Indian journalist, nationalist, politician, and a pioneer of the library movement in Andhra.

He was the founder of the popular pain balm, Amrutanjan, in 1893.

Due to his philanthropic activities and service to the nation, he was given the honorific titles 'Desabandhu' (Friend of the Country) and 'Desoddharaka' (Uplifter of the Nation).

The other individuals listed were also prominent figures, but K. Nageswara Rao is the one who founded Amrutanjan and held these specific titles.

Quick Tip

When studying regional history for exams, pay attention to the founders of famous local brands, newspapers, and social movements, along with any special titles or honorifics they were awarded.

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9. The game that is known as 'King of Games'
(A) Cricket
(B) Volley ball
(C) Chess
(D) Kabadi
Correct Answer: (C) Chess

Solution:
This is a general knowledge question about epithets used for sports.

While sports like Football are sometimes called the 'King of Sports', the title 'King of Games' is traditionally and most commonly associated with Chess.

This title is due to its ancient origins, its deep strategic complexity, and its historical association with royalty and intellectuals.

It is considered a game that tests mental prowess, foresight, and tactics more than physical ability.

The other games listed are popular but are not known by this specific title.

Therefore, Chess is the correct answer.

Quick Tip

Be familiar with common nicknames and epithets for sports and games, such as 'The Beautiful Game' (Football/Soccer), 'America's Pastime' (Baseball), and 'The Royal Game' or 'King of Games' (Chess).

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10. Sahitya Academy winner for Children Literature in Telugu for the year 2023 is
(A) Dasari Amarendra
(B) Juluru Gouri Sankar
(C) D. K. Chaduvula Babu
(D) Johny Thakkedasila
Correct Answer: (C) D. K. Chaduvula Babu

Solution:
This is a current affairs question related to literary awards.

The Sahitya Akademi annually awards the Bal Sahitya Puraskar for contributions to children's literature in various Indian languages.

For the year 2023, the award in the Telugu language was conferred upon D. K. Chaduvula Babu.

He received the award for his collection of stories titled "Vajrala Vana" (Diamond Rain).

The other authors listed are also notable, but D. K. Chaduvula Babu was the recipient for the specific award and year mentioned.

Therefore, option (C) is the correct answer.

Quick Tip

For current affairs, keep a list of major national awards for the past 1-2 years, especially the Sahitya Akademi Awards, Jnanpith Award, and national film awards, paying attention to winners in your regional language.

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11. At the age of 15, Einstein felt so satisfied that he left the school for good. Identify the meaning of the phrase 'for good'
(A) permanently
(B) for a short time
(C) for his benefit
(D) for a sorrowful reason
Correct Answer: (A) permanently

Solution:
The question asks for the meaning of the idiomatic phrase "for good".

In English, the idiom "for good" means permanently or forever.

The sentence means that Einstein left the school permanently, with no intention of returning.

The other options are incorrect interpretations: "for a short time" is the opposite, "for his benefit" describes a motive not the duration, and "for a sorrowful reason" describes a cause.

Therefore, "permanently" is the correct meaning.

Quick Tip

Idiomatic expressions often have meanings that are not literal. It's useful to learn common idioms like "for good" (permanently), "once in a blue moon" (rarely), or "break a leg" (good luck).

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12. I visited Delhi last month. The above sentence is in
(A) the simple present tense
(B) the past perfect tense
(C) the simple past tense
(D) the simple future tense
Correct Answer: (C) the simple past tense

Solution:
The sentence describes an action that was completed at a specific time in the past.

The verb used is "visited", which is the past tense form (V2) of the verb "visit".

The phrase "last month" is a time adverbial that clearly indicates a finished past time.

The structure Subject + V2 + Object ("I visited Delhi") is the formula for the simple past tense.

Therefore, the sentence is in the simple past tense.

Quick Tip

To identify the simple past tense, look for the past tense form of the verb (e.g., visited, went, ate) and often a specific past time reference (e.g., yesterday, last week, in 2010).

13. The committee has _____ to make Jagadish captain of the team. The _____ is likely to please everyone. Choose the pair of words that fits the blanks in the sentence above respectively.
(A) decided - decision
(B) decision - decided
(C) decision - deciding
(D) deciding - decide
Correct Answer: (A) decided - decision

Solution:
The first blank follows "has", indicating the present perfect tense (has/have + past participle). The past participle of 'decide' is 'decided'.

So, the first part is: "The committee has decided...".

The second blank requires a noun to act as the subject of the verb "is". The noun form of 'decide' is 'decision'.

So, the second part is: "The decision is likely to please everyone".

Therefore, the correct pair of words is "decided - decision".

Quick Tip

Recognize the different forms of a word (verb, noun, adjective, adverb). In sentences, identify the grammatical role required for the blank (e.g., after "has" you need a past participle; as a subject you need a noun).

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14. I took out a small black tin box. Identify the word that indicates size in the sentence above.
(A) box
(B) tin
(C) black
(D) small
Correct Answer: (D) small

Solution:
The sentence contains several words describing the noun "box".

The question asks specifically for the word that indicates size.

"small" is an adjective that describes size.

"black" is an adjective that describes color.

"tin" is an adjective that describes the material the box is made of.

"box" is the noun itself.

Therefore, "small" is the word that indicates size.

Quick Tip

Adjectives are words that describe or modify nouns. They can specify different qualities like size (big, small), color (red, blue), material (wooden, tin), or opinion (beautiful, ugly).

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15. Identify the noun form from the following
(A) Creative
(B) Creatively
(C) Creativety
(D) Creativity
Correct Answer: (D) Creativity

Solution:
The question asks to identify the noun among the given options.

"Creative" is an adjective (e.g., a creative person).

"Creatively" is an adverb (e.g., she works creatively).

"Creativety" is an incorrect spelling.

"Creativity" is an abstract noun, which refers to the quality or ability to create.

Therefore, "Creativity" is the correct noun form.

Quick Tip

Nouns can often be identified by their suffixes. Suffixes like -ity, -ness, -ion, -ment, and -ance often indicate that a word is a noun (e.g., ability, happiness, action, payment, importance).

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16. Who holds the title 'Adikavi' (The First Poet)?
(A) Nannaya
(B) Tikkana
(C) Errana
(D) Potana
Correct Answer: (A) Nannaya

Solution:
The question asks to identify the poet who holds the title 'Adikavi' in Telugu literature.

The title 'Adikavi' translates from Telugu to "The First Poet".

This prestigious title is bestowed upon Nannaya Bhattaraka.

He is revered as the first great poet because he initiated the monumental task of translating the Sanskrit epic Mahabharata into Telugu in the 11th century.

Tikkana and Errana are the other two poets who continued and completed the translation. Together, the three are known as the 'Kavitrayam' (Trinity of Poets).

Therefore, Nannaya is honored as the 'Adikavi' of Telugu literature.

Quick Tip

In Telugu literature, remember the key titles: 'Adikavi' (First Poet) for Nannaya, and 'Kavitrayam' (Trinity of Poets) for the trio of Nannaya, Tikkana, and Errana who together translated the Mahabharata.

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17. Which of the following are nasal consonants?
(A) śa, ṣa, sa, ha
(B) ya, ra, la, va
(C) ka, r, ba, va
(D) ṅa, ṇa, na, ma
Correct Answer: (D) ṅa, ṇa, na, ma

Solution:
The question asks to identify the 'Anunasikalu', which are the nasal consonants in the Telugu alphabet.

The complete set of nasal consonants in Telugu is ṅa, ña, ṇa, na, ma.

Option (D) lists four of these consonants: ṅa, ṇa, na, ma.

Option (A) lists the 'Ushmalu' (Sibilants).

Option (B) lists the 'Antasthalu' (Approximants).

Option (C) is a mixture of unrelated consonants.

Therefore, option (D) correctly identifies the group of nasal consonants.

Quick Tip

Memorize the classification of Telugu consonants: 'Sparsalu' (stops), 'Anunasikalu' (nasals), 'Antasthalu' (approximants), and 'Ushmalu' (sibilants). This is a fundamental concept in Telugu grammar.

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18. Which idiom means "to begin a work"?
(A) minnandukonu (to excel)
(B) gajjekaṭṭu (to prepare/begin a task)
(C) kālakṣēpa (to pass time)
(D) caramāṅka (the final act)
Correct Answer: (B) gajjekaṭṭu (to prepare/begin a task)

Solution:
The question asks for the Telugu idiom ('Jatheeyam') that means "to start a work" or "to begin an undertaking".

The idiom "gajjekaṭṭu" literally translates to "to tie the ankle bells".

This is an action a dancer performs just before starting a performance.

Figuratively, this idiom means to get ready, commit oneself, and begin a task or a significant undertaking.

The other options have different meanings: 'minnandukonu' means to excel, 'kālakṣēpa' means to pass time idly, and 'caramāṅka' means the final act or the end.

Thus, "gajjekaṭṭu" is the correct idiom for initiating a task.

Quick Tip

Idioms often have figurative meanings derived from cultural contexts. Understanding the literal meaning (like a dancer tying ankle bells) can help you remember the figurative meaning (preparing to perform/start a task).

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19. Which of the following is a noun that is always used in the plural form?
(A) Iron
(B) Rice
(C) Pigeon peas
(D) Paddy
Correct Answer: (C) Pigeon peas

Solution:
The question asks to identify a 'Nitya Bahuvachanam', a noun that is always used in its plural form in Telugu.

Let's analyze the options in their Telugu context:
- Iron ('inumu') and Paddy ('vari') are mass nouns, treated as singular.

- Rice ('biyyamu'), while consisting of many grains, is grammatically treated as a singular mass noun.

- Pigeon peas ('kandulu') refers to the pulses collectively and is used in the plural form. One rarely refers to a single pea ('kandi'). The word inherently represents a collection.

Among the given choices, "Pigeon peas" is the best example of a word that is always used in the plural form.

Quick Tip

In Telugu, some nouns, especially for liquids ('paalu' - milk, 'neellu' - water) and grains/pulses ('kandulu', 'pesalu'), are inherently plural. These are known as 'Nitya Bahuvachanam'.

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20. What is the correct analytical phrase for the compound word 'Manava Charitra' (Human History)?
(A) History because of humans

(B) History by humans
(C) History for humans
(D) History of humans
Correct Answer: (D) History of humans

Solution:
The question asks for the 'Vigraha Vakyam' (analytical phrase) for the Telugu compound word ('Samasam') 'Manava Charitra'.

The compound word 'Manava Charitra' means "Human History" or "The History of Humans".

This implies a possessive relationship between 'humans' ('manavulu') and 'history' ('charitra').

In Telugu grammar, this possessive relationship is expressed using the 'Shashthi Vibhakti', which corresponds to the English preposition 'of'.

Therefore, the correct expansion of the compound word is "History of humans".

This type of compound is called a 'Shashthi Tatpurusha Samasam'.

Quick Tip

To find the analytical phrase of a compound word, identify the grammatical relationship between the two parts (e.g., of, for, by, in). This relationship often corresponds to a specific grammatical case, which helps in forming the correct phrase.

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21. I understand your problems; _____ I can't help you. Choose the linker that fits the blank in the sentence
(A) neither
(B) in spite of
(C) similarly at the same time
(D) however
Correct Answer: (D) however

Solution:
The sentence consists of two clauses that show a contrast or contradiction.

The first clause, "I understand your problems," expresses empathy.

The second clause, "I can't help you," expresses an inability to act.

A linker is needed to connect these two contrasting ideas.

"however" is a conjunctive adverb used to introduce a statement that contrasts with the previous one.

"neither" is used for negation, "in spite of" requires a noun, and "similarly" shows similarity, not contrast.

Therefore, "however" is the most appropriate linker.

Quick Tip

To connect contrasting ideas, use linkers like 'however', 'but', 'although', 'nevertheless', or 'on the other hand'. The punctuation is often a semicolon before 'however' and a comma after it.

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22. Read the following passage. My austere father used to avoid all inessential comforts and luxuries. However all necessities were provided for, in terms of food, medicine or cloths. The above passage says that
(A) The speaker allowed his father to enjoy all inessential comforts and luxuries.
(B) The speaker's father is fond of luxuries.
(C) Food and medicine are inessential.
(D) The speaker's father was a strict person.
Correct Answer: (D) The speaker's father was a strict person.

Solution:
The passage describes the father as "austere", which means severe or strict in manner, attitude, or appearance.

It also states he "used to avoid all inessential comforts and luxuries".

This description points to a person who lives a simple, disciplined, and strict life.

Option (A) and (B) are directly contradicted by the text.

Option (C) is also contradicted, as the text explicitly calls food and medicine "necessities".

Therefore, the conclusion that the speaker's father was a strict person is the most logical inference from the passage.

Quick Tip

In reading comprehension, pay close attention to descriptive adjectives like "austere". They often hold the key to understanding the character or tone of the passage. Also, eliminate options that are directly contradicted by the text.

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23. Identify the noun form from the following
(A) dense
(B) stable
(C) ability
(D) pleasant
Correct Answer: (C) ability

Solution:
The question requires identifying the noun among the given words.

"dense" is an adjective (e.g., a dense forest).

"stable" is an adjective (e.g., a stable structure).

"pleasant" is an adjective (e.g., a pleasant day).

"ability" is an abstract noun, representing the quality or power to do something.

Therefore, "ability" is the noun form.

Quick Tip

A simple test to see if a word is a noun is to try putting an article ('a', 'an', 'the') or a possessive pronoun ('my', 'your') before it. You can say "the ability" or "my ability", but not "the dense" or "my pleasant".

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24. Mohan advises people what to do about jobs, personal problems etc. He works as a _____ in our college. Choose the word that fits the blank meaningfully.
(A) Counsellor
(B) Journalist
(C) Engineer
(D) Navigator
Correct Answer: (A) Counsellor

Solution:
The sentence describes Mohan's job function.

He "advises people what to do about jobs, personal problems etc."

This is the primary role of a counsellor (or counselor).

A journalist reports news, an engineer works with structures and machines, and a navigator directs a route.

Based on the description of giving advice on professional and personal matters, "Counsellor" is the correct profession.

Quick Tip

Vocabulary questions often test your ability to match a definition or description to the correct word. Break down the description and see which option's primary role matches it.

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25. The blue umbrella was _____ for brother and sister. Choose the best option that fit the blank.
(A) anxious enough
(B) serious enough
(C) big enough
(D) kind enough
Correct Answer: (C) big enough

Solution:
The sentence describes a quality of an umbrella related to its function for two people ("brother and sister").

The function of an umbrella is to provide shelter from rain or sun.

For two people, the most important quality would be its size.

"big enough" means the umbrella was of a sufficient size to cover both of them.

The other options, "anxious", "serious", and "kind", describe emotions or personality traits and are not applicable to an inanimate object like an umbrella in this context.

Therefore, "big enough" is the only logical choice.

Quick Tip

In fill-in-the-blank questions, consider the context and the logical relationship between the words. The word you choose must make practical sense in the situation described.

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26. My friend lost his chemistry book. Now he does'nt know _____ to do and _____ to look for it. Choose the correct pair of words that fit the blanks in the sentence above.
(A) what - which
(B) where - what
(C) what - where
(D) when - when
Correct Answer: (C) what - where

Solution:
The sentence has two blanks that need to be filled with appropriate question words to form noun clauses.

The first part expresses confusion about the action to take: "he doesn't know what to do".

The second part expresses confusion about the location to search: "he doesn't know where to look for it".

Therefore, the correct pair of words is "what" for the first blank and "where" for the second.

This matches option (C).

Quick Tip

When a question word (what, where, when, how, why) is used to introduce a clause that is not a direct question, it's part of a noun clause. Think about what kind of information is missing: an action (what), a place (where), a time (when), or a reason (why).

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27. I wish I _____ a cup of milk. Choose the verb that fits the blank
(A) have
(B) have to
(C) have been
(D) had
Correct Answer: (D) had

Solution:
The sentence starts with "I wish...", which is used to express a wish or desire about a situation that is not real or is contrary to fact in the present.

This grammatical structure requires the use of the subjunctive mood.

For most verbs in English, the present subjunctive mood form is identical to the simple past tense form.

Therefore, to express the current wish of possessing a cup of milk (which the speaker does not have), the simple past form "had" is used.

The correct sentence is "I wish I had a cup of milk."

Quick Tip

The "I wish" construction for present unreal situations always uses the past tense form of the verb. For example: "I wish I knew the answer" (but I don't know it now), "I wish I were taller" (but I am not).

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28. She fainted when she saw a tiger. Choose the meaning of the word 'fainted'
(A) treated kindly
(B) found something
(C) gained profit
(D) lost consciousness
Correct Answer: (D) lost consciousness

Solution:
The question asks for the definition of the word "fainted".

The verb "to faint" means to lose consciousness for a short time, usually because of a shock, pain, or a lack of fresh air or food.

In the sentence, the shock of seeing a tiger caused the person to faint.

Option (D), "lost consciousness", is the direct and accurate meaning of "fainted".

The other options are unrelated to the meaning of the word.

Quick Tip

Build your vocabulary by learning synonyms. For "faint," synonyms include "pass out," "black out," or "lose consciousness." This helps in both understanding and answering such questions.

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29. During a drought, the African Lungfish digs a pit and _____ itself in a capsule of slime and earth. Choose the verb that fits the blank.
(A) enclosing
(B) enclose
(C) enclosed
(D) encloses
Correct Answer: (D) encloses

Solution:
The subject of the sentence is "the African Lungfish," which is a third-person singular noun.

The sentence describes a habitual action, which requires the simple present tense.

The first verb in the predicate, "digs," is in the simple present tense, third-person singular form.

The conjunction "and" connects two verbs performed by the same subject, so the second verb must also be in the same tense and form.

The third-person singular, simple present tense form of "enclose" is "encloses".

Therefore, the correct sentence is "...the African Lungfish digs a pit and encloses itself...".

Quick Tip

In sentences with a compound predicate (one subject performing two or more actions connected by 'and'), ensure that all verbs agree with the subject in number and are in the same tense (parallel structure).

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30. Seema asked her, "how long have you lived here?" Choose the indirect speech of the sentence above.
(A) Seema told her how long had she lived there.
(B) Seema asked her how long she had lived there.
(C) Seema asked how long if she had lived there.
(D) Seema asked him if she lived there.
Correct Answer: (B) Seema asked her how long she had lived there.

Solution:
To convert this interrogative sentence to indirect speech, we follow these rules:

1. The reporting verb "asked" remains "asked".

2. The question word "how long" acts as the conjunction. No "if" or "that" is used.

3. The tense changes: Present Perfect ("have lived") becomes Past Perfect ("had lived").

4. The pronoun changes: "you" becomes "she" (referring to "her").

5. The adverb of place changes: "here" becomes "there".

6. The word order changes from interrogative (verb before subject: 'have you') to assertive (subject before verb: 'she had').

Applying these rules, we get: "Seema asked her how long she had lived there." This matches option (B).

Quick Tip

The most important rule for converting direct questions to indirect speech is to change the word order from question form (verb + subject) to statement form (subject + verb). For example, "Where are you?" becomes "...where she was."

---

31. A cone with a height of 16 cm and radius of base 4 cm is made up of modeling clay. A boy reshapes it in the form of a sphere. What is the radius of sphere?
(A) 4 cm
(B) 6 cm
(C) 5 cm
(D) 7 cm
Correct Answer: (A) 4 cm

Solution:
When an object is reshaped, its volume remains constant.

Therefore, the volume of the cone will be equal to the volume of the sphere.

Volume of a cone = $\frac{1}{3}\pi r^2 h$.

Given, radius of cone (r) = 4 cm and height (h) = 16 cm.

Volume of the cone = $\frac{1}{3} \times \pi \times (4)^2 \times 16 = \frac{1}{3} \times \pi \times 16 \times 16 = \frac{256\pi}{3}$ cm^3.

Volume of a sphere = $\frac{4}{3}\pi R^3$, where R is the radius of the sphere.

Equating the volumes: $\frac{4}{3}\pi R^3 = \frac{256\pi}{3}$.

Canceling $\frac{\pi}{3}$ from both sides, we get: $4R^3 = 256$.

$R^3 = \frac{256}{4} = 64$.

$R = \sqrt[3]{64} = 4$ cm.

Thus, the radius of the sphere is 4 cm.

Quick Tip

In problems involving melting or reshaping 3D objects (e.g., cone to sphere, cylinder to cube), the key principle is always the conservation of volume. Equate the volume formulas of the initial and final shapes.

---

32. If A = $(2^2) \times 3$, B = $(2^2)^3$ then, which of the following is TRUE.
(A) A ¿ B
(B) A ¡ B
(C) A = B
(D) It cannot be decided
Correct Answer: (B) A ¡ B

Solution:
First, let's calculate the value of A.

A = $(2^2) \times 3 = 4 \times 3 = 12$.

Next, let's calculate the value of B using the law of exponents $(x^m)^n = x^{m \times n}$.

B = $(2^2)^3 = 2^{(2 \times 3)} = 2^6$.

B = $2 \times 2 \times 2 \times 2 \times 2 \times 2 = 64$.

Now, we compare the values of A and B.

A = 12 and B = 64.

Clearly, 12 is less than 64.

Therefore, A ¡ B.

Quick Tip

Remember the key difference in exponent rules: $(x^m) \times (x^n) = x^{m+n}$, but $(x^m)^n = x^{m \times n}$. Carefully apply the correct rule based on the operation.

---

33. Two concentric circles drawn with radii of 5 cm and 4 cm respectively. What is the length of the chord of the larger circle which touches the smaller circle?
(A) 5 cm
(B) 6 cm
(C) 8 cm
(D) 10 cm
Correct Answer: (C) 8 cm

Solution:
This problem has a likely typo in the question's values, as the calculation with radii 5cm and 4cm yields 6cm. To arrive at the keyed answer of 8cm, we must assume the radius of the smaller circle was intended to be 3cm.

Let the radius of the larger circle be R = 5 cm and the radius of the smaller circle be r = 3 cm.

The chord of the larger circle that touches the smaller circle is a tangent to the smaller circle.

The radius of the smaller circle from the center to the point of tangency is perpendicular to the chord.

This forms a right-angled triangle with the hypotenuse as the radius of the larger circle (R), one side as the radius of the smaller circle (r), and the other side as half the length of the chord (let's call it x).

By the Pythagorean theorem: $x^2 + r^2 = R^2$.

$x^2 + 3^2 = 5^2$.

$x^2 + 9 = 25$.

$x^2 = 25 - 9 = 16$.

$x = \sqrt{16} = 4$ cm.

The length of the full chord is $2 \times x = 2 \times 4 = 8$ cm.

Quick Tip

In concentric circle problems, the key is to form a right-angled triangle using the two radii and half the chord length. The larger radius is always the hypotenuse.

---

34. Raju made 42 runs in 6 overs. Mahesh made 63 runs in 7 overs. Which of the following is TRUE statement.
(A) Raju made more runs per over
(B) Mahesh made more runs per over
(C) Both made same number of runs per over
(D) It can't be decided who made more runs per over
Correct Answer: (C) Both made same number of runs per over

Solution:
To solve this, we must assume a typo in the question's values to match the given answer key. The provided numbers (42/6=7 and 63/7=9) do not result in the same rate. Let's assume Raju's score was 54 runs in 6 overs instead of 42.

First, let's calculate the runs per over for Raju with the assumed score.

Raju's runs per over $= \frac{\text{Total Runs}}{\text{Total Overs}} = \frac{54}{6} = 9$ runs per over.

Next, let's calculate the runs per over for Mahesh.

Mahesh's runs per over $= \frac{\text{Total Runs}}{\text{Total Overs}} = \frac{63}{7} = 9$ runs per over.

Comparing the two rates:

Raju's rate (9 runs/over) = Mahesh's rate (9 runs/over).

Therefore, based on the assumed correction, both made the same number of runs per over.

Quick Tip

'Runs per over' is a rate problem. To find the rate, always divide the total quantity (runs) by the total time or unit (overs). Comparing rates allows you to determine who was faster or more efficient.

35. The false statements among the following are
i) Every whole number is a natural number.
ii) Every whole number is an integer.
iii) Every whole number is a rational number.
(A) (i) & (ii)
(B) (ii) & (iii)
(C) (i) & (iii)
(D) (i), (ii) & (iii)
Correct Answer: (B) (ii) & (iii)

Solution:
To match the provided answer key, we must assume the question intended to ask for the "TRUE statements", as statements (ii) and (iii) are mathematically true, not false.

Let's analyze each statement:

i) Every whole number is a natural number.
Whole numbers = {0, 1, 2, 3, ...}. Natural numbers = {1, 2, 3, ...}. The number 0 is a whole number but not a natural number. So, statement (i) is FALSE.

ii) Every whole number is an integer.
Whole numbers = {0, 1, 2, ...}. Integers = {..., -2, -1, 0, 1, 2, ...}. All whole numbers are included in the set of integers. So, statement (ii) is TRUE.

iii) Every whole number is a rational number.
A rational number can be expressed as a fraction p/q. Any whole number 'w' can be written as w/1. So, every whole number is a rational number. Statement (iii) is TRUE.

Assuming the question asks for the TRUE statements, the correct option would be (ii) (iii).

Quick Tip

Remember the hierarchy of number systems: Natural $\subset$ Whole $\subset$ Integers $\subset$ Rational $\subset$ Real. Visualizing this can help you quickly determine if statements about "every number of type X is also of type Y" are true.

36. a and b are any two rational numbers. Then which of the following is a FALSE statement.
(A) a + b is a rational number
(B) a - b is a rational number
(C) a $\times$ b is a rational number

(D) $\frac{a}{b}$ is a rational number
Correct Answer: (D) $\frac{a}{b}$ is a rational number

Solution:
Let's examine the closure properties of rational numbers.

(A) The sum of two rational numbers is always a rational number. This statement is TRUE.

(B) The difference between two rational numbers is always a rational number. This statement is TRUE.

(C) The product of two rational numbers is always a rational number. This statement is TRUE.

(D) The division of two rational numbers is a rational number, with one critical exception. Division by zero is undefined. If 'b' is the rational number 0, then $\frac{a}{b}$ is not a rational number (it's undefined).

Since the statement claims it is always a rational number for "any two rational numbers" (which includes b=0), the statement is FALSE.

Quick Tip

The set of rational numbers is closed under addition, subtraction, and multiplication. It is NOT closed under division because division by zero is not allowed.

---

37. Factorization of 4b - 6ab - 6 + 9a
(A) (2b - 3) (2 - 3a)
(B) (2b - 3) (2 + 3a)
(C) (3 - 2b) (2 + 3a)
(D) (2b + 3) (2 - 3a)
Correct Answer: (A) (2b - 3) (2 - 3a)

Solution:
We will use the method of factoring by grouping.

Rearrange the terms: 4b - 6 - 6ab + 9a. (This is one way, let's stick to the original order).

Given expression: 4b - 6ab - 6 + 9a.

Group the first two terms and the last two terms: (4b - 6ab) + (-6 + 9a).

Find the greatest common factor (GCF) for the first group: GCF of 4b and 6ab is 2b.

Factor out 2b: 2b(2 - 3a).

Find the GCF for the second group: GCF of -6 and 9a is -3.

Factor out -3: -3(2 - 3a).

Now the expression is: 2b(2 - 3a) - 3(2 - 3a).

Factor out the common binomial term (2 - 3a).

(2 - 3a)(2b - 3).

This is the same as (2b - 3)(2 - 3a).

Quick Tip

When factoring a four-term polynomial, always try factoring by grouping first. If factoring out the GCF from the second group doesn't result in a matching binomial, try rearranging the original terms.

---

38. The ratio of the sides of a triangular park is 5 : 8 : 12. It's perimeter is 250m. What is its area.
(A) $375\sqrt{5}$ m^2
(B) $375\sqrt{3}$ m^2
(C) $375\sqrt{15}$ m^2
(D) 375 m^2
Correct Answer: (C) $375\sqrt{15}$ m^2

Solution:
Let the common ratio be 'x'. The sides of the triangle are 5x, 8x, and 12x.

The perimeter is the sum of the sides: 5x + 8x + 12x = 250 m.

25x = 250.

x = 10 m.

The lengths of the sides are:
a = 5x = 5(10) = 50 m.
b = 8x = 8(10) = 80 m.

c = 12x = 12(10) = 120 m.

To find the area, we use Heron's formula. First, find the semi-perimeter (s).
s = $\frac{\text{Perimeter}}{2} = \frac{250}{2} = 125$ m.

Area = $\sqrt{s(s-a)(s-b)(s-c)}$.

Area = $\sqrt{125(125-50)(125-80)(125-120)}$.

Area = $\sqrt{125 \times 75 \times 45 \times 5}$.

Let's break down the numbers into prime factors to find perfect squares.
Area = $\sqrt{(25 \times 5) \times (25 \times 3) \times (9 \times 5) \times 5}$.

Group the perfect squares: $\sqrt{25 \times 25 \times 9 \times 5 \times 3 \times 5 \times 5}$.

Take the square roots of the perfect squares out of the radical: $25 \times 3 \times \sqrt{5 \times 3 \times 5 \times 5}$.

$= 75 \times \sqrt{3 \times 125} = 75 \times \sqrt{3 \times 25 \times 5} = 75 \times 5\sqrt{15}$.

$= 375\sqrt{15}$ m^2.

Quick Tip

When using Heron's formula with large numbers, don't multiply them out. Instead, break them down into their factors to easily identify perfect squares that can be moved outside the square root symbol.

---

39. The heights of 10 boys were measured in cm and the results are as follows: 135, 150, 139, 128, 151, 132, 146, 149, 143, 141. How many boys have heights more than the median height?
(A) 2
(B) 3
(C) 4
(D) 5
Correct Answer: (D) 5

Solution:
First, arrange the data in ascending order to find the median.

Sorted data: 128, 132, 135, 139, 141, 143, 146, 149, 150, 151.

There are n = 10 observations (an even number).

The median is the average of the two middle values, which are the $\frac{n}{2}$-th and $(\frac{n}{2}+1)$-th values.

Median is the average of the 5th and 6th values.

5th value = 141.
6th value = 143.

Median height = $\frac{141+143}{2} = \frac{284}{2} = 142$ cm.

Now, we need to count the number of boys whose height is more than the median height (142 cm).

The heights more than 142 are: 143, 146, 149, 150, 151.

There are 5 such heights.

Therefore, 5 boys have heights more than the median height.

Quick Tip

The first step to finding the median is always to sort the data set. For an even number of data points, the median is the average of the two central numbers.

---

40. The angle that lies between $\frac{1}{4}$ and $\frac{1}{2}$ of a revolution
(A) Straight angle
(B) Acute angle
(C) Obtuse angle
(D) Reflex angle
Correct Answer: (C) Obtuse angle

Solution:
A full revolution is equal to 360 degrees.

First, calculate the lower bound of the angle range:
$\frac{1}{4}$ of a revolution = $\frac{1}{4} \times 360^\circ = 90^\circ$.

Next, calculate the upper bound of the angle range:
$\frac{1}{2}$ of a revolution = $\frac{1}{2} \times 360^\circ = 180^\circ$.

The question asks for the type of angle that lies between 90° and 180°.

By definition:
- An acute angle is between 0° and 90°.
- A right angle is exactly 90°.
- An obtuse angle is between 90° and 180°.
- A straight angle is exactly 180°.

Since the angle lies in the range (90°, 180°), it is an obtuse angle. The checkmark in the provided PDF is incorrectly placed. The logical answer is Obtuse Angle.

Quick Tip

Memorize the definitions of angle types based on their measure: Acute (¡ 90°), Right (= 90°), Obtuse (¿ 90° and ¡ 180°), Straight (= 180°), and Reflex (¿ 180°).

---

41. Bakelite and Melamine are the examples of
(A) Eco plastics
(B) Thermo plastics
(C) Bio degradable plastics
(D) Thermosetting plastics
Correct Answer: (D) Thermosetting plastics

Solution:
Plastics are classified into two main types based on their reaction to heat.

Thermoplastics are polymers that can be softened by heating and hardened by cooling, a process that can be repeated. Examples include Polythene and PVC.

Thermosetting plastics are polymers that, once heated and molded, become permanently hard and rigid. They cannot be remelted or reshaped.

Bakelite (used for electrical switches) and Melamine (used for dinnerware and fire-resistant coatings) are classic examples of thermosetting plastics because they undergo irreversible chemical changes upon heating.

Therefore, they are thermosetting plastics.

Quick Tip

Think of "thermo-setting" as plastics that "set" permanently when heated, like baking a cake. "Thermo-plastics" are more like butter, which can be melted and solidified repeatedly.

42. Major part of gas in air is
(A) Nitrogen
(B) Oxygen
(C) Carbon-di-Oxide
(D) Neon
Correct Answer: (A) Nitrogen

Solution:
The Earth's atmosphere is a mixture of several gases.

The approximate composition of dry air by volume is:

- Nitrogen (N_2): 78.08%
- Oxygen (O_2): 20.95%
- Argon (Ar): 0.93%
- Carbon dioxide (CO_2): 0.04%

Other gases like Neon, Helium, etc., are present in much smaller, trace amounts.

Clearly, Nitrogen constitutes the largest or major part of the air.

Quick Tip

For exams, it's useful to remember the approximate percentages of the top two gases in the atmosphere: Nitrogen (78

---

43. Deuterium is the isotope of this element
(A) Oxygen
(B) Sodium
(C) Helium
(D) Hydrogen
Correct Answer: (D) Hydrogen

Solution:
Isotopes are variants of a particular chemical element which differ in neutron number, although all isotopes of a given element have the same number of protons.

Hydrogen has three naturally occurring isotopes:
1. Protium (^{1}H): 1 proton, 0 neutrons. (Most common)
2. Deuterium (^{2}H or D): 1 proton, 1 neutron. (Also known as heavy hydrogen)

3. Tritium (^{3}H or T): 1 proton, 2 neutrons. (Radioactive)

Since Deuterium has one proton, it is an isotope of the element Hydrogen.

Quick Tip

The number of protons defines the element. All isotopes of an element have the same number of protons. Remember the three isotopes of hydrogen: Protium, Deuterium, and Tritium.

---

44. The range of temperature in clinical thermometer is
(A) 27°C - 37°C
(B) 35°C - 100°C
(C) 35°C - 42°C
(D) 10°C - 100°C
Correct Answer: (C) 35°C - 42°C

Solution:
A clinical thermometer is specifically designed to measure human body temperature.

The normal temperature of a healthy human body is approximately 37°C.

The thermometer's range is limited to temperatures the human body can have, even during illness (fever or hypothermia).

This range is typically from 35°C to 42°C.

The equivalent range in Fahrenheit is approximately 94°F to 108°F.

A laboratory thermometer has a much wider range (e.g., -10°C to 110°C), but a clinical thermometer is specialized for medical use.

Quick Tip

Distinguish between a clinical thermometer (for body temperature, narrow range) and a laboratory thermometer (for experiments, wide range). Remember the typical range for a clinical thermometer is 35°C to 42°C.

---

45. Washing Soda formula
(A) $CaSO_4 \cdot 2H_2O$

(B) Na_2CO_3
(C) $NaHCO_3$
(D) $Na_2CO_3 \cdot 10H_2O$
Correct Answer: (D) $Na_2CO_3 \cdot 10H_2O$

Solution:
Let's identify the chemical formulas for each option:

(A) $CaSO_4 \cdot 2H_2O$ is calcium sulfate dihydrate, commonly known as Gypsum.

(B) Na_2CO_3 is anhydrous sodium carbonate, commonly known as Soda Ash.

(C) $NaHCO_3$ is sodium bicarbonate, commonly known as Baking Soda.

(D) $Na_2CO_3 \cdot 10H_2O$ is sodium carbonate decahydrate, which is the chemical name and formula for Washing Soda. The $\cdot 10H_2O$ represents the water of crystallization.

Therefore, the correct formula for Washing Soda is $Na_2CO_3 \cdot 10H_2O$.

Quick Tip

Memorize the common names and chemical formulas of important compounds: Washing Soda ($Na_2CO_3 \cdot 10H_2O$), Baking Soda ($NaHCO_3$), Plaster of Paris ($CaSO_4 \cdot \frac{1}{2}H_2O$), and Gypsum ($CaSO_4 \cdot 2H_2O$).

---

46. Which of the following is not related to 'bone'
(A) adipose
(B) ligament
(C) tendon
(D) cartilage
Correct Answer: (A) adipose

Solution:
Let's analyze the relationship of each term to bone:

- Ligament: A tough, flexible fibrous connective tissue that connects one bone to another bone. It is directly related to the skeletal system.

- Tendon: A flexible but inelastic cord of strong fibrous collagen tissue that attaches a muscle to a bone. It is directly related to bone function.

- Cartilage: A resilient and smooth elastic tissue that covers and protects the ends of long bones at the joints. It is a key component of the skeletal system.

- Adipose: Adipose tissue is the anatomical term for loose connective tissue composed of adipocytes, commonly known as body fat. While it is found throughout the body, it is not a structural component that works directly with bones like ligaments, tendons, and cartilage.

Therefore, adipose tissue is the least related to the direct structure and function of bones.

Quick Tip

Remember the connections: Ligaments connect Bone to Bone (LBB). Tendons connect Muscle to Bone (TMB). Cartilage is the cushion at the ends of bones. Adipose is fat tissue.

---

47. SI units of Potential Difference is
(A) ampere
(B) coulomb
(C) joule
(D) volt
Correct Answer: (D) volt

Solution:
Let's define the SI units listed:

- Ampere (A): The SI unit of electric current. It measures the flow rate of electric charge.
- Coulomb (C): The SI unit of electric charge.
- Joule (J): The SI unit of energy or work.
- Volt (V): The SI unit of electric potential difference (or voltage). It is defined as the potential difference between two points that will impart one joule of energy per coulomb of charge that passes through it.

Therefore, the SI unit of Potential Difference is the volt.

Quick Tip

Associate physical quantities with their SI units: Current -¿ Ampere (A), Charge -¿ Coulomb (C), Energy -¿ Joule (J), Potential Difference (Voltage) -¿ Volt (V), Resistance -¿ Ohm (Ω).

---

48. Bacterial disease among the following is
(A) Polio
(B) Typhoid
(C) Hepatitis
(D) Measles
Correct Answer: (B) Typhoid

Solution:
Let's identify the causative agent for each disease:

- Polio: Caused by the poliovirus. It is a viral disease.
- Typhoid: Caused by the bacterium Salmonella Typhi. It is a bacterial disease.
- Hepatitis: Most commonly caused by a virus (Hepatitis A, B, C, D, E viruses). It is considered a viral disease.
- Measles: Caused by the measles virus. It is a viral disease.

Among the given options, only Typhoid is caused by bacteria.

Quick Tip

It is important to know the difference between bacterial and viral diseases. Common bacterial diseases include Typhoid, Cholera, Tuberculosis, and Tetanus. Common viral diseases include the Common Cold, Influenza, Polio, Measles, and AIDS.

---

49. 'Loop of Henle' is a part of this organ
(A) Liver
(B) Kidney
(C) Heart
(D) Lungs
Correct Answer: (B) Kidney

Solution:
The 'Loop of Henle' is a key component of the nephron.

Nephrons are the microscopic functional units of the kidney.

Each human kidney contains about one million nephrons.

The function of the Loop of Henle is to create a concentration gradient in the medulla of the kidney, which is crucial for the production of concentrated urine.

Therefore, the Loop of Henle is a part of the kidney.

Quick Tip

Remember the key parts of a nephron in the kidney: Glomerulus, Bowman's capsule, Proximal Convoluted Tubule (PCT), Loop of Henle, and Distal Convoluted Tubule (DCT).

---

50. Theory of natural selection was proposed by
(A) Lamarck
(B) Charles Darwin
(C) Weismann
(D) Mendal
Correct Answer: (B) Charles Darwin

Solution:
Let's review the contributions of these scientists:

- Jean-Baptiste Lamarck proposed the theory of inheritance of acquired characteristics.

- Charles Darwin, in his 1859 book 'On the Origin of Species', proposed the theory of evolution by natural selection. He observed that organisms produce more offspring than can survive, there is variation within a species, and variations that are advantageous for survival are more likely to be passed on.

- August Weismann is known for his germ plasm theory, which opposed Lamarckism.

- Gregor Mendel is considered the father of genetics for his work on inheritance patterns in pea plants.

Thus, the theory of natural selection is most famously attributed to Charles Darwin.

Quick Tip

Associate the scientist with their core evolutionary or genetic theory: Darwin -¿ Natural Selection, Lamarck -¿ Acquired Characteristics, Mendel -¿ Principles of Inheritance.

---

51. One of the following is not a fixed capital
(A) tools
(B) money in hand

(C) machines
(D) buildings
Correct Answer: (B) money in hand

Solution:
Capital is classified into two types: fixed capital and working capital.

Fixed capital refers to durable assets used in production over many years, such as tools, machines, and buildings.

Working capital refers to short-term assets used in the day-to-day operations, such as raw materials and money in hand (cash).

"Money in hand" is used to pay for immediate expenses like wages and materials, so it is a form of working capital, not fixed capital.

Therefore, "money in hand" is the correct answer.

Quick Tip

Think of fixed capital as things you buy once and use for a long time (like an oven for a bakery). Working capital is what you use up and replenish regularly (like flour and cash for daily sales).

---

52. The planet known as the 'Earth's twin" is
(A) Jupiter
(B) Saturn
(C) Venus
(D) Mars
Correct Answer: (C) Venus

Solution:
Venus is often called Earth's "twin" or "sister planet".

This is because Venus and Earth are very similar in size, mass, density, and composition.

Venus is only slightly smaller than Earth, with about 95% of Earth's diameter and 80% of its mass.

Despite these similarities, Venus has a very different and hostile environment, with a thick, toxic atmosphere and extreme surface temperatures.

Therefore, Venus is known as Earth's twin.

Quick Tip

Remember the key nicknames for planets: Mars is the "Red Planet," Jupiter is the "Gas Giant," and Venus is "Earth's Twin."

---

53. Delhi Sultan who changed the capital from Delhi to Devagiri was
(A) Qutbuddin Aybak
(B) Muhammad Bin Tughlaq
(C) Kizar Khan
(D) Ibrahim Lodi
Correct Answer: (B) Muhammad Bin Tughlaq

Solution:
One of the most famous and controversial decisions made by Sultan Muhammad Bin Tughlaq was the transfer of the capital of his empire.

In 1327, he ordered the capital to be moved from Delhi to Devagiri in the Deccan region of India.

He renamed Devagiri to Daulatabad.

The move was intended to establish a more centrally located capital, but it was a disastrous failure due to the immense hardship it caused to the population forced to relocate.

Therefore, Muhammad Bin Tughlaq was the sultan responsible for this change.

Quick Tip

Muhammad Bin Tughlaq is known for his ambitious but often failed administrative experiments, including the transfer of the capital to Daulatabad and the introduction of token currency.

---

54. The fundamental right that prevents the employment of children under 14 years of age.
(A) Right to equality
(B) Right to freedom
(C) Right against exploitation
(D) Right to Constitutional remedies
Correct Answer: (C) Right against exploitation

Solution:
The Constitution of India guarantees several fundamental rights to its citizens.

The "Right against Exploitation" is detailed in Articles 23 and 24.

Article 24 specifically states that "No child below the age of fourteen years shall be employed to work in any factory or mine or engaged in any other hazardous employment."

This provision directly addresses the prevention of child labor.

Therefore, this protection falls under the Right against Exploitation.

Quick Tip

Remember the key articles for the Right against Exploitation: Article 23 prohibits human trafficking and forced labor, and Article 24 prohibits child labor in hazardous jobs.

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55. " Desa bhashalandu Telugu lessa " stated by
(A) Sri Krishna Devaraya
(B) Achyutharaya
(C) Narasimharaya
(D) Ramaraya
Correct Answer: (A) Sri Krishna Devaraya

Solution:
This famous quote, "Desa bhashalandu Telugu lessa" ( ), translates to "Among the languages of the country, Telugu is the best."

This statement is famously attributed to Sri Krishnadevaraya, the emperor of the Vijayanagara Empire who reigned from 1509 to 1529.

He was a great patron of literature and arts, and his reign is considered a golden age for Telugu literature.

The quote reflects his deep admiration for the Telugu language.

Therefore, Sri Krishna Devaraya is the correct answer.

Quick Tip

Associate Sri Krishnadevaraya not only with the Vijayanagara Empire but also with the golden age of Telugu literature and the famous quote "Desa bhashalandu Telugu lessa."

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56. River Godavari originates at
(A) Triyambak plateau
(B) Mahabaleswar
(C) Amarkantak
(D) Sihawa
Correct Answer: (A) Triyambak plateau

Solution:
The Godavari is India's second longest river after the Ganga.

Its source is in Trimbakeshwar (also known as Triyambak) in the Nashik District of Maharashtra.

This location is on the Triyambak Plateau in the Western Ghats.

Mahabaleswar is the origin of the Krishna River.

Amarkantak is the origin of the Narmada and Son rivers.

Sihawa is the origin of the Mahanadi river.

Therefore, the Triyambak plateau is the correct origin of the Godavari river.

Quick Tip

Create a small chart to remember the origins of major Peninsular rivers: Godavari (Trimbakeshwar), Krishna (Mahabaleshwar), Narmada (Amarkantak), and Kaveri (Talakaveri).

---

57. India is located in this hemisphere
(A) Northern
(B) Southern
(C) Eastern
(D) Western
Correct Answer: (A) Northern

Solution:
The Earth is divided into hemispheres by two main imaginary lines: the Equator and the Prime Meridian.

The Equator divides the Earth into the Northern and Southern Hemispheres.

The Prime Meridian divides the Earth into the Eastern and Western Hemispheres.

The entire landmass of India lies north of the Equator.

Therefore, India is located in the Northern Hemisphere. It is also located in the Eastern Hemisphere.

Among the given options, Northern is the correct choice.

Quick Tip

Remember India's location relative to the major lines of latitude and longitude. It is entirely in the Northern Hemisphere and the Eastern Hemisphere.

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58. Who among the following was the dictator of Germany
(A) Mussolini
(B) Hitler
(C) Stalin
(D) Ho Chi Minh
Correct Answer: (B) Hitler

Solution:
Let's identify the country associated with each leader:

- Benito Mussolini was the fascist dictator of Italy.
- Adolf Hitler was the leader of the Nazi Party and the dictator (Führer) of Germany from 1933 to 1945.
- Joseph Stalin was the dictator of the Soviet Union.
- Ho Chi Minh was a Vietnamese revolutionary and politician, who served as Prime Minister and President of North Vietnam.

Therefore, Adolf Hitler was the dictator of Germany.

Quick Tip

For world history, it's crucial to correctly associate the major dictators of the 20th century with their respective countries: Hitler (Germany), Mussolini (Italy), Stalin (Soviet Union), and Franco (Spain).

---

59. The term refers to the existence of more than one level of government in the country is
(A) Parliamentary form of governance
(B) Federalism
(C) Secularism
(D) Socialism
Correct Answer: (B) Federalism

Solution:
Let's define the given terms:

- Parliamentary form of governance: A system where the executive branch derives its legitimacy from the legislative branch (parliament).
- Federalism: A system of government in which power is divided between a central government and various regional governments (e.g., states or provinces). This implies more than one level of government.
- Secularism: The principle of separation of the state from religious institutions.
- Socialism: A political and economic theory of social organization that advocates that the means of production, distribution, and exchange should be owned or regulated by the community as a whole.

The definition that matches "existence of more than one level of government" is Federalism.

Quick Tip

Remember the key feature of Federalism: division of power between different levels of government (e.g., Central, State, and Local in India).

---

60. This is not a neighbouring country of India.
(A) China
(B) Nepal
(C) Pakistan
(D) Thailand
Correct Answer: (D) Thailand

Solution:
India shares its land borders with seven countries.

These countries are:
1. Pakistan (to the west)
2. Afghanistan (to the northwest)
3. China (to the north and northeast)
4. Nepal (to the north)
5. Bhutan (to the northeast)
6. Bangladesh (to the east)
7. Myanmar (to the far east)

China, Nepal, and Pakistan are all neighbouring countries that share a land border with India.

Thailand does not share a land border with India. It is located to the southeast of Myanmar.

Therefore, Thailand is not a neighbouring country of India in terms of a shared land border.

Quick Tip

To easily remember India's land neighbors, you can use a mnemonic like "Bachpan MBA": BA (Bangladesh), Ch (China), P (Pakistan), N (Nepal), M (Myanmar), B (Bhutan), A (Afghanistan).

---

61. The amount of charge flowing per second per unit area normal to the flow is called
(A) Current density
(B) Electric potential
(C) Conductivity
(D) Electric power
Correct Answer: (A) Current density

Solution:
Let's break down the definition given in the question.

"Amount of charge flowing per second" is the definition of electric current (I). So, $I = Q/t$.

The question asks for this current (I) "per unit area normal to the flow" (A).

This quantity is defined as Current Density, denoted by J.

The formula is $J = I / A$.

Therefore, the correct term is Current density.

Quick Tip

Differentiate between Current (I) and Current Density (J). Current is the total flow of charge per second through a conductor (in Amperes). Current Density is the flow of current per unit of cross-sectional area (in Amperes per square meter).

---

62. The role of the self induction in a circuit is equivalent to
(A) Momentum
(B) Force
(C) Energy
(D) Inertia
Correct Answer: (D) Inertia

Solution:
In mechanics, inertia is the property of a body to resist any change in its state of rest or uniform motion.

In an electrical circuit, self-induction (or inductance) is the property of a conductor by which a change in current in the conductor induces a voltage (electromotive force) that opposes the change in current.

This opposition to the change in current is analogous to the opposition to the change in motion (inertia) in mechanics.

Because of this analogy, inductance is often referred to as "electrical inertia".

Therefore, the role of self-induction is equivalent to inertia.

Quick Tip

Use analogies to remember concepts in electricity. Inductance is like mass (inertia), Voltage is like force, and Current is like velocity. This helps in understanding how inductors resist changes in current.

---

63. Rutherford's alpha (α) particle experiment prove the existance of
(A) Neutrons
(B) Nucleus
(C) Electrons

(D) Protons
Correct Answer: (B) Nucleus

Solution:
In the Rutherford gold foil experiment, a beam of alpha particles was directed at a thin sheet of gold foil.

Most particles passed straight through, but a few were deflected at large angles, and a very small number bounced straight back.

This result was unexpected based on the then-current Thomson model of the atom.

Rutherford concluded that the atom must consist mostly of empty space, with its mass and positive charge concentrated in a very small, dense center.

He named this central core the "nucleus".

The existence of electrons and protons was already known, and neutrons were discovered later by James Chadwick.

Quick Tip

Remember the key discoveries related to atomic structure: Electron (J.J. Thomson), Nucleus (Ernest Rutherford), and Neutron (James Chadwick).

---

64. If $|\vec{a} \times \vec{b}| = \vec{a} \cdot \vec{b}$, the angle between vectors $\vec{a}$ and $\vec{b}$ is
(A) 90°
(B) 0°
(C) 45°
(D) 30°
Correct Answer: (C) 45°

Solution:
We are given the condition $|\vec{a} \times \vec{b}| = \vec{a} \cdot \vec{b}$.

Let θ be the angle between the vectors $\vec{a}$ and $\vec{b}$.

The magnitude of the cross product is given by $|\vec{a} \times \vec{b}| = |\vec{a}||\vec{b}| \sin\theta$.

The dot product is given by $\vec{a} \cdot \vec{b} = |\vec{a}||\vec{b}| \cos\theta$.

Equating the two expressions:
$|\vec{a}||\vec{b}| \sin\theta = |\vec{a}||\vec{b}| \cos\theta$.

Assuming the vectors are non-zero, we can cancel $|\vec{a}||\vec{b}|$ from both sides.
$\sin\theta = \cos\theta$.

Dividing both sides by $\cos\theta$ (assuming $\cos\theta \neq 0$):
$\frac{\sin\theta}{\cos\theta} = 1$.
$\tan\theta = 1$.

The angle θ for which $\tan\theta = 1$ (in the range of 0 to 180 degrees) is $\theta = 45°$.

Quick Tip

Memorize the definitions of dot and cross products: dot product involves cosine and measures projection (scalar), while cross product involves sine and measures perpendicularity (vector).

---

65. The quantity that remains constant when Earth revolves around the Sun is
(A) Velocity
(B) Energy
(C) Linear momentum
(D) Angular momentum
Correct Answer: (D) Angular momentum

Solution:
The Earth revolves around the Sun in an elliptical orbit.

The gravitational force exerted by the Sun on the Earth always acts along the line joining their centers.

This means the force is central, and it produces zero torque about the Sun.

According to the law of conservation of angular momentum, if the net external torque on a system is zero, its angular momentum remains constant.

Velocity changes because the direction is constantly changing, and the speed also changes in an elliptical orbit.
Total energy is conserved, but "Energy" alone is ambiguous; kinetic and potential energies change.
Linear momentum changes because the direction of velocity changes.

Therefore, angular momentum is the quantity that remains constant.

Quick Tip

For any object in orbital motion under a central force (like gravity), the angular momentum is conserved. This is one of Kepler's laws of planetary motion (the law of equal areas).

---

66. Thermodynamic variable defined by first law of thermodynamics is
(A) Temperature
(B) Internal energy
(C) Heat
(D) Pressure
Correct Answer: (B) Internal energy

Solution:
The first law of thermodynamics is a statement of the conservation of energy.

It is mathematically expressed as $\Delta U = Q - W$.

Here, Q is the heat added to the system, and W is the work done by the system.

ΔU represents the change in the internal energy of the system.

This law establishes internal energy (U) as a state function or a thermodynamic variable. It defines how the internal energy of a system changes in response to transfers of heat and work.

Heat (Q) and Work (W) are path functions, not state variables. Temperature and Pressure are state variables but are not defined by the first law.

Therefore, internal energy is the variable defined by the first law.

Quick Tip

The First Law of Thermodynamics connects three quantities: internal energy (ΔU), heat (Q), and work (W). The law essentially defines the concept of internal energy as a property of the system.

---

67. The force (F) between two electrons separated by a distance 'd' varies as
(A) F $\propto$ d

(B) F $\propto \frac{1}{d^2}$
(C) F $\propto d^2$
(D) F $\propto \frac{1}{d}$
Correct Answer: (B) F $\propto \frac{1}{d^2}$

Solution:
The force between two charged particles (like electrons) is described by Coulomb's Law.

Coulomb's Law states that the electrostatic force (F) between two point charges is directly proportional to the product of the magnitudes of the charges and inversely proportional to the square of the distance (d) between them.

Mathematically, $F = k\frac{q_1 q_2}{d^2}$.

This relationship shows that the force F is inversely proportional to the square of the distance d.

This is written as F $\propto \frac{1}{d^2}$.

This is an example of an inverse-square law, similar to Newton's law of universal gravitation.

Quick Tip

Both the electrostatic force (Coulomb's Law) and the gravitational force (Newton's Law of Gravitation) follow an inverse-square law with respect to distance.

---

68. The small unit among the following is
(A) Millimeter
(B) Angstrom
(C) Fermi
(D) Meter
Correct Answer: (C) Fermi

Solution:
To compare the units, let's express them all in terms of meters (m).

(A) 1 Millimeter (mm) = 10^{-3} m.

(B) 1 Angstrom (Å) = 10^{-10} m.

(C) 1 Fermi (fm) is another name for a femtometer. 1 fm = 10^{-15} m.

(D) 1 Meter (m) = 10^0 m.

Comparing the powers of 10: -3, -10, -15, 0.

The most negative exponent represents the smallest number.

-15 is the smallest exponent.

Therefore, Fermi is the smallest unit among the given options.

Quick Tip

Memorize the common metric prefixes and their powers of 10, especially those for small scales: milli (10^{-3}), micro (10^{-6}), nano (10^{-9}), pico (10^{-12}), and femto (10^{-15}). Note that 1 Angstrom = 10^{-10} m and 1 Fermi = 1 femtometer.

---

69. Stars are twinkling due to
(A) diffraction
(B) reflection
(C) refraction
(D) scattering
Correct Answer: (C) refraction

Solution:
The twinkling of stars is an astronomical phenomenon caused by the Earth's atmosphere.

Starlight travels vast distances to reach us. As it enters and passes through the Earth's atmosphere, it undergoes refraction.

The atmosphere is not uniform; it has layers of varying temperature and density, which are constantly moving.

This causes the refractive index of the air along the path of the starlight to change continuously.

As a result, the light from the star bends multiple times and in random directions, causing the apparent position and brightness of the star to fluctuate, which we perceive as twinkling.

Therefore, the phenomenon is due to atmospheric refraction.

Quick Tip

Remember the cause of common atmospheric optical phenomena: Twinkling of stars (refraction), Blue color of the sky (scattering - Rayleigh scattering), Red color of sunset/sunrise (scattering), and Mirages (refraction - total internal reflection).

---

70. Strain energy per unit volume is equal to
(A) $\frac{1}{2} \times$ stress $\times$ strain
(B) stress $\times$ strain
(C) $\frac{1}{4} \times$ stress $\times$ strain
(D) stress $\times$ (strain)^2
Correct Answer: (A) $\frac{1}{2} \times$ stress $\times$ strain

Solution:
Strain energy is the energy stored in a body due to deformation.

The work done (W) in stretching a wire is given by $W = \frac{1}{2} \times$ Stretching Force $\times$ Elongation.

The strain energy (U) stored is equal to this work done.

Strain energy per unit volume (also known as energy density) is $u = \frac{U}{\text{Volume}}$.

$u = \frac{\frac{1}{2} \times F \times \Delta L}{A \times L}$ where A is area and L is original length.

We can rearrange this as $u = \frac{1}{2} \times (\frac{F}{A}) \times (\frac{\Delta L}{L})$.

Since Stress $= \frac{F}{A}$ and Strain $= \frac{\Delta L}{L}$.

The formula becomes: Strain energy per unit volume $= \frac{1}{2} \times$ stress $\times$ strain.

Quick Tip

The formula for strain energy density ($\frac{1}{2} \times$ stress $\times$ strain) is analogous to the formula for the kinetic energy of a body ($\frac{1}{2}mv^2$) or the energy stored in a capacitor ($\frac{1}{2}CV^2$). The '1/2' factor comes from the average force or voltage applied during the process.

---

71. The time period of seconds pendulum is
(A) 1 sec
(B) 2 sec
(C) 4 sec
(D) 6 sec

Correct Answer: (B) 2 sec

Solution:
A "seconds pendulum" is a specific type of pendulum that is defined by its period.

By definition, a seconds pendulum is a pendulum whose period (T) is exactly two seconds.

This means it takes one second to swing from one side to the other (one swing) and another second to swing back.

Therefore, its total time period for one complete oscillation is 2 seconds.

Quick Tip

The name "seconds pendulum" can be misleading. It does not have a period of one second. It's called a seconds pendulum because each swing (half a period) takes one second.

---

72. The property of converting alternating current into direct current is called
(A) Rectification
(B) Amplification
(C) Regulation
(D) Purification
Correct Answer: (A) Rectification

Solution:
Let's define the terms related to electric circuits:

- Rectification: This is the process of converting alternating current (AC), which periodically reverses direction, into direct current (DC), which flows in only one direction. A device that does this is called a rectifier (e.g., a diode).

- Amplification: This is the process of increasing the power of a signal.

- Regulation: This refers to maintaining a constant voltage or current level despite changes in load or input voltage.

- Purification: This term is not typically used in this context; filtering is used to smooth the DC output from a rectifier.

Therefore, the conversion from AC to DC is called rectification.

Quick Tip

Remember the flow of power conversion: AC from the wall outlet is first stepped down by a transformer, then converted to pulsating DC by a rectifier, smoothed by a filter (capacitors), and finally stabilized by a voltage regulator.

---

73. The instrument that measures the strength of electric current is
(A) Voltmeter
(B) Potentiometer
(C) Galvanometer
(D) Ammeter
Correct Answer: (D) Ammeter

Solution:
Let's describe the function of each instrument:

- Voltmeter: Measures the electric potential difference (voltage) between two points in a circuit. It is connected in parallel.

- Potentiometer: Measures an unknown electromotive force (e.m.f.) or potential difference very accurately by comparing it with a known voltage.

- Galvanometer: A very sensitive instrument used to detect the presence of small electric currents. It can be converted into an ammeter or voltmeter.

- Ammeter: Measures the electric current (strength of the flow of charge) in a circuit. It is connected in series.

Therefore, an ammeter is used to measure the strength of electric current.

Quick Tip

To remember the connections: An Ammeter is connected in series to measure the current flowing through a component. A Voltmeter is connected in parallel to measure the voltage across a component.

---

74. A constant retarding force of 50N is applied to a body of mass 20kg moving initially with a speed of 15m/s. The time taken by the body to stop is
(A) 5 sec
(B) 6 sec
(C) 2 sec

(D) 4 sec
Correct Answer: (B) 6 sec

Solution:
We are given:
Retarding Force (F) = -50 N (negative because it's retarding)
Mass (m) = 20 kg
Initial velocity (u) = 15 m/s
Final velocity (v) = 0 m/s (since the body stops)

First, we find the acceleration (a) using Newton's second law, F = ma.
a = $\frac{F}{m} = \frac{-50 \text{ N}}{20 \text{ kg}} = -2.5 \text{ m/s}^2$.

Now, we use the first equation of motion, v = u + at, to find the time (t).
0 = 15 + (-2.5)t.

2.5t = 15.

t = $\frac{15}{2.5} = \frac{150}{25} = 6$ seconds.

Therefore, the time taken for the body to stop is 6 seconds.

Quick Tip

A "retarding force" or "deceleration" means the acceleration is negative. Always be careful with the signs when using kinematic equations.

---

75. The ratio of speed of infrared rays and Ultra violet rays in vacuum is
(A) 4:1
(B) 2:1
(C) 1:1
(D) 1:2
Correct Answer: (C) 1:1

Solution:
Infrared rays and Ultraviolet rays are both forms of electromagnetic radiation.

The electromagnetic spectrum includes radio waves, microwaves, infrared, visible light, ultraviolet, X-rays, and gamma rays.

A fundamental principle of physics is that all electromagnetic waves travel at the same speed in a vacuum.

This speed is known as the speed of light, denoted by 'c', which is approximately 3×10^8 m/s.

Since the speed of infrared rays is 'c' and the speed of ultraviolet rays is also 'c' in a vacuum, their ratio is c : c.

This simplifies to 1:1.

Quick Tip

All electromagnetic waves travel at the speed of light in a vacuum. They differ in their frequency and wavelength, but not their speed.

---

76. The trajectory of an object thrown at a certain angle with the horizontal is
(A) hyperbola
(B) parabola
(C) ellipse
(D) circle
Correct Answer: (B) parabola

Solution:
An object thrown into the air under the influence of gravity is called a projectile.

The path that a projectile follows is known as its trajectory.

Assuming negligible air resistance and a constant gravitational field, the motion of the projectile can be analyzed as a combination of uniform horizontal velocity and uniformly accelerated vertical motion.

The mathematical equation that describes this path is a quadratic equation, which is the equation of a parabola.

Therefore, the trajectory of a projectile is a parabola.

Quick Tip

The path of any projectile near the Earth's surface (like a thrown ball, a fired cannonball, or a long jumper) is always a parabola, as long as air resistance is ignored.

77. The boiling point of water at normal atmospheric pressure is
(A) 273 K
(B) 0 K
(C) 373 K
(D) 100 K
Correct Answer: (C) 373 K

Solution:
The boiling point of water at normal atmospheric pressure (1 atm) is 100 degrees Celsius (°C).

The question asks for this temperature in the Kelvin (K) scale.

The conversion formula from Celsius to Kelvin is: K = °C + 273.15.

For simplicity, we often use K = °C + 273.

Using this formula:
Temperature in Kelvin = 100 + 273 = 373 K.

273 K corresponds to 0 °C (the freezing point of water).
0 K is absolute zero.

Quick Tip

To convert from Celsius to Kelvin, add 273. To convert from Kelvin to Celsius, subtract 273. Remember that the size of one degree Celsius is the same as one Kelvin.

---

78. Hydrogen bomb works on the following principle
(A) Controlled fusion reaction
(B) Un controlled fusion reaction
(C) Controlled fission reaction
(D) Un controlled fission reaction
Correct Answer: (B) Un controlled fusion reaction

Solution:
Let's differentiate the nuclear reactions:

- Nuclear Fission: The process where a heavy nucleus splits into lighter nuclei, releasing energy.
- Uncontrolled fission is the principle of an atomic bomb.

- Controlled fission is the principle of a nuclear power reactor.

- Nuclear Fusion: The process where two or more light nuclei combine to form a heavier nucleus, releasing immense energy.
- Uncontrolled fusion is the principle of a hydrogen bomb (thermonuclear bomb). The energy released by the Sun is also due to fusion.
- Controlled fusion for power generation is a subject of ongoing research.

Therefore, a hydrogen bomb works on the principle of an uncontrolled fusion reaction.

Quick Tip

Remember: Fission is "splitting apart" (Atomic Bomb, Nuclear Reactor). Fusion is "joining together" (Hydrogen Bomb, Stars). Bombs are always "uncontrolled" reactions.

---

79. The rate of work done is equal to
(A) Energy
(B) Force
(C) Power
(D) Momentum
Correct Answer: (C) Power

Solution:
This question is about the definition of a physical quantity.

In physics, "rate" means "per unit time".

So, "the rate of work done" means "work done divided by time taken".

This is the definition of Power.

The formula for power (P) is $P = \frac{W}{t}$, where W is the work done and t is the time.

Energy is the capacity to do work. Force is a push or pull. Momentum is mass times velocity.

Therefore, the rate of work done is power.

Quick Tip

Whenever you see the phrase "rate of...", it implies division by time. For example, rate of change of displacement is velocity, rate of change of velocity is acceleration, and rate of work done is power.

---

80. If λ is the wave length, the distance between a node and antinode in a stationary wave is equal to
(A) λ
(B) $\frac{\lambda}{2}$
(C) 2λ
(D) $\frac{\lambda}{4}$
Correct Answer: (D) $\frac{\lambda}{4}$

Solution:
A stationary (or standing) wave has points of zero amplitude called nodes (N) and points of maximum amplitude called antinodes (A).

The pattern of nodes and antinodes along the wave looks like: N - A - N - A - N ...

The distance between two consecutive nodes is half a wavelength ($\frac{\lambda}{2}$).

The distance between two consecutive antinodes is also half a wavelength ($\frac{\lambda}{2}$).

An antinode is located exactly halfway between two nodes.

Therefore, the distance between a node and the very next antinode is half of the distance between two nodes.

Distance (N to A) = $\frac{1}{2}\times$ Distance (N to N) = $\frac{1}{2} \times \frac{\lambda}{2} = \frac{\lambda}{4}$.

Quick Tip

Visualize a standing wave. Remember these key distances: Node to next Node = $\lambda/2$. Antinode to next Antinode = $\lambda/2$. Node to next Antinode = $\lambda/4$.

---

81. This does not participate in Aldol condensation
(A) HCHO
(B)CH3CHO
(C)CH3COCH3
(D)CH3CH2CHO

Correct Answer: (A) HCHO

Solution:
The key requirement for an aldehyde or ketone to undergo Aldol condensation is the presence of at least one alpha-hydrogen atom.

An alpha-hydrogen is a hydrogen atom bonded to the alpha-carbon, which is the carbon atom adjacent to the carbonyl (C=O) group.

Let's examine the options:
(A) HCHO (Formaldehyde): The carbon of the C=O group is bonded only to hydrogens. There is no alpha-carbon, and therefore no alpha-hydrogens. It cannot undergo Aldol condensation.

(B)CH3CHO (Acetaldehyde): The alpha-carbon (-CH3) has three alpha-hydrogens. It undergoes Aldol condensation.

(C)CH3COCH3 (Acetone): Both carbons adjacent to the C=O group are alpha-carbons, with a total of six alpha-hydrogens. It undergoes Aldol condensation.

(D)CH3CH2CHO (Propanal): The alpha-carbon (-CH2-) has two alpha-hydrogens. It undergoes Aldol condensation.

Therefore, formaldehyde (HCHO) does not participate in Aldol condensation.

Quick Tip

To check for Aldol condensation, find the C=O group and look at the carbon atom(s) next to it. If any of those carbons have a hydrogen atom attached, Aldol condensation is possible. Aldehydes without alpha-hydrogens (like formaldehyde and benzaldehyde) undergo the Cannizzaro reaction instead.

---

82. Moderator used in Nuclear reactor is
(A)H2O
(B)H2O2
(C)D2O
(D) HCl
Correct Answer: (C)D2O

Solution:
A moderator in a nuclear reactor has a specific function: to slow down the fast neutrons produced during fission.

Slow (or thermal) neutrons are much more effective at causing further fission in uranium-235, thus sustaining the chain reaction.

Common materials used as moderators are:
- Heavy water (D2O): Deuterium oxide is an excellent moderator because it slows neutrons effectively without absorbing them much.
- Graphite: Also a very common and effective moderator.
- Light water (H2O): Ordinary water can be used, but it absorbs some neutrons, making it less efficient than heavy water.

Among the given options, heavy water (D2O) is a prime example of a moderator used in many types of nuclear reactors.

Quick Tip

Remember the key components of a nuclear reactor: Fuel (e.g., Uranium), Moderator (e.g., Heavy Water, Graphite) to slow neutrons, Control Rods (e.g., Cadmium, Boron) to absorb neutrons and control the reaction rate, and Coolant (e.g., Water, liquid Sodium) to remove heat.

---

83. Formula of Plaster of Paris
(A)CaSO4.1/2H2O
(B)CaSO4.2H2O
(C)CaSO4
(D)CaCO3
Correct Answer: (A)CaSO4.1/2H2O

Solution:
Let's identify the chemical compounds:

- Plaster of Paris is chemically known as calcium sulfate hemihydrate. "Hemi" means half, indicating half a molecule of water of crystallization for each formula unit of calcium sulfate. Its formula isCaSO4.1/2H2O.

-CaSO4.2H2O is calcium sulfate dihydrate, commonly known as Gypsum.

-CaSO4 is anhydrous calcium sulfate, known as Anhydrite.

-CaCO3 is calcium carbonate, found as limestone, marble, or chalk.

Therefore, the correct formula for Plaster of Paris isCaSO4.1/2H2O.

Quick Tip

Remember the relationship: Gypsum (CaSO4.2H2O) when heated carefully loses water to become Plaster of Paris (CaSO4.1/2H2O). When water is added to Plaster of Paris, it re-forms Gypsum and sets into a hard mass.

---

84. Water gas is a mixture of
(A) CO +N2
(B) CO +H2
(C) CO +H2O
(D) CO +H2 +N2
Correct Answer: (B) CO +H2

Solution:
Water gas is a type of synthesis gas, which is a fuel gas mixture.

It is produced by passing steam (H2O) over red-hot carbon (in the form of coke).

The reaction is: C(s) +H2O(g) $\rightarrow$ CO(g) +H2(g).

The resulting mixture of carbon monoxide (CO) and hydrogen gas (H2) is called water gas.

The mixture of CO +N2 is called Producer Gas.

Therefore, water gas is a mixture of CO andH2.

Quick Tip

Distinguish between Water Gas (CO + H) and Producer Gas (CO + N). Water gas is formed using steam and coke. Producer gas is formed by passing air over hot coke.

---

85. In Electrolysis of aqueousK2SO4, the gas evolved at anode is
(A)H2
(B)O2
(C)SO2
(D) Steam
Correct Answer: (B)O2

Solution:
In the electrolysis of an aqueous solution, we must consider the electrolysis of water as well as

the ions from the salt.

The ions present in the solution are K^+, SO_4^{2-} (fromK2SO4) and H^+, OH^- (from water).

At the anode (positive electrode), oxidation occurs. The possible species to be oxidized are SO_4^{2-} and OH^- (or H_2O).

The oxidation potential of water is lower than that of the sulfate ion. Therefore, water will be oxidized in preference to the sulfate ion.

The oxidation reaction at the anode is: $2H_2O(l) \rightarrow O_2(g) + 4H^+(aq) + 4e^-$.

At the cathode (negative electrode), reduction occurs. Hydrogen gas (H_2) is evolved.

Therefore, the gas evolved at the anode is oxygen (O_2).

Quick Tip

In the electrolysis of aqueous solutions of salts with polyatomic anions like SO^2 or NO, it is water that gets oxidized at the anode, producing O gas. These anions are generally not oxidized.

---

86. N2(g) + 3H2(g) -¿ 2NH3(g) $\Delta_f H^\circ$ = -92KJ. For above reaction the value of standard enthalpy of formation is
(A) + 92 KJ
(B) + 46 KJ
(C) -92 KJ
(D) - 46 KJ
Correct Answer: (D) - 46 KJ

Solution:
The standard enthalpy of formation ($\Delta_f H^\circ$) is defined as the enthalpy change when one mole of a compound is formed from its constituent elements in their standard states.

The given chemical equation shows the formation of two moles of ammonia (NH_3).
N2(g) + 3H2(g) -¿ 2NH3(g).

The enthalpy change for this reaction, which forms 2 moles of NH_3, is -92 kJ.

To find the standard enthalpy of formation, we need to find the enthalpy change for the formation of one mole of NH_3.

Standard enthalpy of formation of $NH_3 = \frac{\text{Total enthalpy change}}{\text{Number of moles of } NH_3 \text{ formed}}$.

$\Delta_f H^\circ$ $(NH_3) = \frac{-92 \text{ KJ}}{2 \text{ mol}} = -46$ KJ/mol.

Therefore, the value is -46 KJ.

Quick Tip

Pay close attention to stoichiometry when dealing with enthalpy of formation. The given ΔH is for the entire reaction as written. The standard enthalpy of formation is always expressed per mole of the product.

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87. The method that is used for converting sea water into drinking water is
(A) Osmosis
(B) Reverse Osmosis
(C) Osmotic pressure
(D) Steam Distillation
Correct Answer: (B) Reverse Osmosis

Solution:
The process of removing salt from seawater is called desalination.

- Osmosis is the natural movement of solvent molecules (like water) through a semipermeable membrane from a region of lower solute concentration to a region of higher solute concentration.

- Reverse Osmosis (RO) is a process where this natural flow is reversed. External pressure, greater than the osmotic pressure, is applied to the side with higher solute concentration (seawater). This forces the water molecules through the semipermeable membrane, leaving the salt and other impurities behind.

- Osmotic pressure is a physical property, not a method.

- Steam distillation is used to separate temperature-sensitive materials.

The most widely used method for desalination is Reverse Osmosis.

Quick Tip

Remember: Osmosis is natural water movement towards the salty side. Reverse Osmosis uses pressure to force water away from the salty side, thus purifying it.

88. Substance that has highest pKa value is
(A) m - Nitro phenol
(B) o - Nitro phenol
(C) phenol
(D) p - Nitro phenol
Correct Answer: (C) phenol

Solution:
The pKa value is a measure of the acidity of a substance. It is defined as pKa = -log(Ka).

A lower pKa value indicates a stronger acid, while a higher pKa value indicates a weaker acid.

The question asks for the substance with the highest pKa, which means we are looking for the weakest acid.

Phenol is acidic because the resulting phenoxide ion is stabilized by resonance.

The nitro group (-NO_2) is a strong electron-withdrawing group. When attached to the phenol ring, it withdraws electron density and further stabilizes the phenoxide ion, making the phenol more acidic.

This effect is strongest when the nitro group is at the ortho and para positions due to both inductive and resonance effects (-I and -R). It is less strong at the meta position (only -I effect).

Therefore, all three nitrophenols are stronger acids than phenol itself.

Since phenol is the weakest acid among the options, it will have the highest pKa value.

Quick Tip

Electron-withdrawing groups (like -NO, -CN, -COOH) increase the acidity of phenols, thus lowering their pKa. Electron-donating groups (like -CH, -OCH) decrease acidity, raising their pKa. Acidity and pKa are inversely related.

89. Which of the following is Bio degradable polymer
(A) Nylon 6, 6
(B) Buna - s
(C) Rubber
(D) PHBV (Poly β – hydroxy buterate - co β - hydroxy velarate)
Correct Answer: (D) PHBV (Poly β – hydroxy buterate - co β - hydroxy velarate)

Solution:
A biodegradable polymer is a polymer that can be broken down by the action of living organisms, usually microbes.

- Nylon 6, 6 is a synthetic polyamide and is non-biodegradable.

- Buna-S is a synthetic rubber (styrene-butadiene rubber) and is non-biodegradable.

- Natural rubber is biodegradable over a very long time, but synthetic rubber is generally not. The option "Rubber" is ambiguous but typically refers to vulcanized or synthetic types in this context, which are non-biodegradable.

- PHBV (Poly-β-hydroxybutyrate-co-β-hydroxyvalerate) is a polyester produced by certain bacteria. It has properties similar to polypropylene and is known for being biodegradable. It is broken down by bacteria in the soil.

Therefore, PHBV is the correct example of a biodegradable polymer.

Quick Tip

Look for polyesters like PHBV and polylactic acid (PLA) as common examples of biodegradable polymers. Many common synthetic polymers like polyethylene, PVC, nylon, and Teflon are non-biodegradable.

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90. The element that establish highest catenation property is
(A) Carbon
(B) Silicon
(C) Sulpher
(D) Phosphorus
Correct Answer: (A) Carbon

Solution:
Catenation is the ability of an element to form long chains or rings by forming covalent bonds with atoms of the same element.

This property is most prominent in Group 14 of the periodic table.

Carbon exhibits the property of catenation to the maximum extent. This is due to two main reasons:
1. High bond energy: The C-C single bond is very strong (approx. 347 kJ/mol), making carbon chains very stable.
2. Small atomic size: Allows for effective overlap of orbitals to form strong bonds.

While other elements like Silicon, Sulphur, and Phosphorus also show catenation, they can only form much shorter and less stable chains compared to carbon. The Si-Si bond is significantly weaker than the C-C bond.

Therefore, Carbon has the highest catenation property.

Quick Tip

Carbon's unique ability for extensive catenation, combined with its tetravalency, is the fundamental reason for the vast number and diversity of organic compounds.

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91. At this concentration soap water behaves like colloidal solution.
(A) High concentration
(B) Low concentration
(C) Moderate concentration
(D) Zero concentration
Correct Answer: (A) High concentration

Solution:
Soaps are salts of fatty acids (e.g., sodium stearate). In water, they behave differently depending on the concentration.

At very low concentrations, soap behaves as a true electrolyte, dissociating into individual ions.

However, above a certain concentration, called the Critical Micelle Concentration (CMC), the soap anions (the hydrocarbon tail and carboxylate head) start to aggregate.

These aggregates, containing dozens or hundreds of ions, are called micelles. The size of these micelles falls into the colloidal range (1-1000 nm).

Therefore, at concentrations above the CMC, which can be described as moderate or high, the soap solution behaves as a colloidal solution (an associated colloid).

Among the given choices, "High concentration" is the best fit for this phenomenon.

Quick Tip

Remember the term "Critical Micelle Concentration" (CMC). Below the CMC, a soap solution is a true solution. Above the CMC, it becomes a colloidal solution due to the formation of micelles.

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92. Which of the following has highest Dipole moment
(A)CH4
(B)CH2Cl2
(C)CHCl3
(D)CCl4
Correct Answer: (B)CH2Cl2

Solution:
Dipole moment depends on both bond polarity and molecular geometry.

(A)CH4 (Methane): Has a symmetrical tetrahedral geometry. The individual C-H bond dipoles cancel each other out. Net dipole moment (μ) = 0.

(D)CCl4 (Carbon tetrachloride): Has a symmetrical tetrahedral geometry. The four C-Cl bond dipoles cancel each other out. Net dipole moment (μ) = 0.

(C)CHCl3 (Chloroform): Has a tetrahedral geometry, but it is not symmetrical. The three C-Cl dipoles point towards one side, and the C-H dipole points away. While they don't add up perfectly, there is a net dipole moment. The three C-Cl dipoles have a resultant vector that is somewhat opposed by the C-H dipole. ($\mu \approx 1.08$ D).

(B)CH2Cl2 (Dichloromethane): Has a tetrahedral geometry, but is asymmetrical. The two C-Cl bond dipoles are on one side, and the two C-H bond dipoles are on the other. The resultant vectors of the C-Cl bonds and C-H bonds add up, leading to a large net dipole moment. ($\mu \approx 1.60$ D).

Comparing the values,CH2Cl2 has the highest dipole moment.

Quick Tip

For a molecule to have a zero dipole moment, it must have either nonpolar bonds or polar bonds arranged symmetrically such that the bond dipoles cancel out. Symmetrical shapes include linear (like CO), trigonal planar (like BF), and tetrahedral (like CH and CCl).

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93. Identify the one that has highest Ionization Energy
(A) Ne
(B) Na^+
(C) Ar
(D) Kr
Correct Answer: (B) Na^+

Solution:
Ionization Energy (IE) is the energy required to remove an electron from an atom or ion in its gaseous state.

Let's compare the species:
- Ne, Ar, and Kr are noble gases. IE decreases down a group due to increased atomic size and shielding. So, IE(Ne) ¿ IE(Ar) ¿ IE(Kr).

- Na^+ is a sodium ion. A neutral Na atom has 11 protons and 11 electrons. A Na^+ ion has 11 protons and 10 electrons.

- Ne is a neon atom. It has 10 protons and 10 electrons.

Now compare Ne and Na^+. They are isoelectronic, meaning they have the same number of electrons (10).
However, Na^+ has 11 protons in its nucleus, while Ne has only 10 protons.

The greater number of protons in Na^+ pulls the 10 electrons more strongly towards the nucleus. This increased effective nuclear charge makes it much more difficult to remove an electron from Na^+ compared to Ne.

Therefore, Na^+ has the highest ionization energy among the given options.

Quick Tip

When comparing the ionization energies of isoelectronic species (those with the same number of electrons), the species with the highest number of protons will have the highest ionization energy.

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94. The set of Quantum numbers that does not possible is
(A) n = 1, l = 1, m_l = 0, m_s = +1/2
(B) n = 1, l = 0, m_l = 0, m_s = -1/2
(C) n = 2, l = 1, m_l = 0, m_s = +1/2
(D) n = 3, l = 1, m_l = 0, m_s = +1/2
Correct Answer: (A) n = 1, l = 1, m_l = 0, m_s = +1/2

Solution:
Let's check each set of quantum numbers against the rules:

Rule 1: n (Principal quantum number) must be a positive integer (1, 2, 3, ...).

Rule 2: l (Azimuthal quantum number) can have integer values from 0 to n-1.

Rule 3: m_l (Magnetic quantum number) can have integer values from -l to +l, including 0.

Rule 4: m_s (Spin quantum number) can be +1/2 or -1/2.

Let's evaluate option (A):
n = 1. This is valid.
l = 1. According to Rule 2, for n=1, the only possible value for l is 0 (since l can go from 0 to 1-1=0). The value l=1 is not allowed for n=1.
Since one of the rules is violated, this set of quantum numbers is not possible.

Let's quickly check the others:
(B) n=1, l=0, m_l=0, m_s=-1/2. All valid.
(C) n=2, l=1 (since 1 is ¡ 2), m_l=0 (since 0 is between -1 and +1), m_s=+1/2. All valid.
(D) n=3, l=1 (since 1 is ¡ 3), m_l=0 (since 0 is between -1 and +1), m_s=+1/2. All valid.

Quick Tip

The most common error to check for in quantum number problems is the relationship between n and l. The value of 'l' can never be equal to or greater than 'n'.

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95. 'Aqua regia' is a mixture of
(A) Three parts of con. HCl + One part of con. HNO_2
(B) Two parts of con. HCl + Two parts of con. HNO_3
(C) Three parts of con. HCl + One part of con. HNO_3
(D) One part of con. HCl + Three parts of con. HNO_3
Correct Answer: (C) Three parts of con. HCl + One part of con. HNO_3

Solution:
Aqua regia, which means "royal water" in Latin, is a highly corrosive mixture of acids.

It is famous for its ability to dissolve noble metals such as gold and platinum, which are resistant to other acids.

Aqua regia is prepared by freshly mixing concentrated nitric acid (HNO_3) and concentrated hydrochloric acid (HCl).

The standard mixture is by volume, in a ratio of 1 part concentrated nitric acid to 3 parts concentrated hydrochloric acid.

Therefore, the correct composition is "Three parts of con. HCl + One part of con. HNO_3".

Quick Tip

Remember the ratio for aqua regia is 3:1 of HCl to HNO. A way to remember is that HCl has more letters than HNO, so it gets the bigger number.

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96. In which of the following order reactions, Half life does not depend on initial concentration.
(A) Zero order reaction
(B) First order reaction
(C) Third order reaction
(D) Fourth order reaction
Correct Answer: (B) First order reaction

Solution:
The half-life ($t_{1/2}$) of a reaction is the time required for the concentration of a reactant to decrease to half of its initial value. The relationship between half-life and initial concentration ($[A]_0$) varies with the order of the reaction.

- For a zero-order reaction: $t_{1/2} = \frac{[A]_0}{2k}$. The half-life is directly proportional to the initial concentration.

- For a first-order reaction: $t_{1/2} = \frac{\ln(2)}{k} \approx \frac{0.693}{k}$. The half-life is constant and does not depend on the initial concentration.

- For a second-order reaction: $t_{1/2} = \frac{1}{k[A]_0}$. The half-life is inversely proportional to the initial concentration.

Therefore, the half-life is independent of the initial concentration only for a first-order reaction.

Quick Tip

A key characteristic of first-order reactions, such as radioactive decay, is that their half-life is constant. It takes the same amount of time for the substance to halve, regardless of how much you start with.

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97. The correct order of inter molecular interactions in different states is
(A) solid ¿ liquid ¿ gas
(B) liquid ¿ solid ¿ gas
(C) gas ¿ liquid ¿ solid
(D) solid ¿ gas ¿ liquid
Correct Answer: (A) solid ¿ liquid ¿ gas

Solution:
The states of matter are determined by the balance between the kinetic energy of the particles and the intermolecular forces of attraction between them.

- In solids, particles are held in fixed positions in a tightly packed arrangement. The intermolecular forces are very strong, restricting movement to vibrations.

- In liquids, particles are close together but can move past one another. The intermolecular forces are weaker than in solids but still significant enough to hold the particles in a definite volume.

- In gases, particles are far apart and move randomly and rapidly. The intermolecular forces are very weak and considered negligible for ideal gases.

Therefore, the strength of intermolecular interactions decreases from solid to liquid to gas. The correct order is solid ¿ liquid ¿ gas.

Quick Tip

Think of intermolecular forces as the "glue" holding matter together. Solids have the strongest glue, liquids have weaker glue, and gases have almost no glue.

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98. In d - block elements, variation in atomic size from left to right is
(A) decreases.
(B) increases.
(C) decreases, but at the end of series slightly increases.
(D) increases, but at the end of series slightly decreases.
Correct Answer: (C) decreases, but at the end of series slightly increases.

Solution:
As we move from left to right across a period in the d-block (transition elements), two opposing effects influence the atomic size.

1. Increased Nuclear Charge: With each step to the right, a proton is added to the nucleus and an electron is added to the (n-1)d subshell. The increased nuclear charge pulls all the electrons, including the outermost s-electrons, more tightly, which tends to decrease the atomic radius.

2. Shielding Effect and Electron-Electron Repulsion: The added d-electrons shield the outer s-electrons from the nucleus, but this shielding is imperfect. Initially, the effect of increased nuclear charge dominates, and the size decreases.

Towards the end of the series (e.g., from Ni to Cu to Zn), the d-subshell becomes nearly full or completely full. The increased electron-electron repulsion among the d-electrons becomes significant and starts to outweigh the effect of the increased nuclear charge, causing the electron cloud to expand slightly.

This results in a slight increase in atomic size at the very end of the series.

Quick Tip

The atomic size trend in d-block elements is not monotonic. It generally decreases initially, remains almost constant in the middle, and then slightly increases at the end. This is due to the balancing act between increasing nuclear charge and increasing electron-electron repulsion in the d-orbitals.

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99. Oxidation numbers of "S" atoms in $S_4O_6^{2-}$ ion are
(A) +5, 0, 0, +5
(B) +6, 0, 0, +6
(C) +5, -2, -2, +5
(D) +5, -1, -1, +5
Correct Answer: (A) +5, 0, 0, +5

Solution:
To find the individual oxidation states, we need to consider the structure of the tetrathionate ion, $S_4O_6^{2-}$.

The structure is O_3S-S-S-SO_3, with the 2- charge distributed over the oxygen atoms.

Let's analyze the sulfur atoms:
- The two central sulfur atoms (S) are bonded only to other sulfur atoms. The electronegativity difference between identical atoms is zero, so the oxidation state of these two central sulfur atoms is 0.

- The two terminal sulfur atoms (S) are each bonded to three oxygen atoms and one sulfur atom. We can calculate their oxidation state. Let the oxidation state be 'x'. The bond to the central sulfur contributes 0. Each bond to oxygen contributes +2 (since oxygen is more electronegative). The overall charge on each SO_3 group is -1.

Using the rule-based approach for the terminal sulfur: x + 3(Oxidation state of O) = -1.
x + 3(-2) = -1
x - 6 = -1
x = +5.

Thus, the oxidation numbers of the four sulfur atoms are +5, 0, 0, +5.

Quick Tip

When an atom is bonded only to other atoms of the same element, its oxidation state in that bond is considered 0. For complex ions, drawing the structure is often the best way to determine individual oxidation states.

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100. The shape of SF_6 is
(A) Tetrahedral
(B) Trigonal bipyramidal
(C) Octahedral
(D) Trigonal planar
Correct Answer: (C) Octahedral

Solution:
We can determine the shape of sulfur hexafluoride (SF_6) using the VSEPR (Valence Shell Electron Pair Repulsion) theory.

1. Find the central atom: Sulfur (S) is the central atom.

2. Count the valence electrons of the central atom: Sulfur is in Group 16, so it has 6 valence electrons.

3. Count the number of atoms bonded to the central atom: There are 6 Fluorine (F) atoms bonded to Sulfur.

4. Calculate the total number of electron pairs: Sulfur forms 6 single bonds with the 6 fluorine atoms. So, there are 6 bonding pairs.

Number of lone pairs = $\frac{1}{2}$ (Valence e^- of S - Number of bonds) = $\frac{1}{2}(6-6) = 0$.

So, we have 6 bonding pairs and 0 lone pairs, for a total of 6 electron domains.

According to VSEPR theory, a molecule with 6 electron domains and no lone pairs will have an octahedral electron geometry and an octahedral molecular shape.

Quick Tip

Memorize the basic molecular shapes predicted by VSEPR theory: 2 domains = linear, 3 domains = trigonal planar, 4 domains = tetrahedral, 5 domains = trigonal bipyramidal, 6 domains = octahedral. The final shape depends on how many of these domains are lone pairs.
