JEECUP 2026 Group A Polytechnic

Question Paper (Memory-Based) With Solution

Conducted by Joint Entrance Examination Council, Uttar Pradesh (JEECUP).

General Instructions

(i) The examination is conducted in Computer-Based Test (CBT) mode.

(ii) Each question carries **+4 marks** for a correct answer and **-1 mark** for a wrong answer.

(iii) The total number of questions is **100**.

(iv) The total duration of the exam is **150 minutes** (2 hours and 30 minutes).

1. A body is moving with a constant speed v in a circular path of radius r. The magnitude of average velocity after half a revolution is:

(A) $\frac{2v}{\pi}$

(B) v

(C) $\frac{v}{\pi}$

(D) zero

Correct Answer: (A) $\frac{2v}{\pi}$

Solution:

Concept: Average velocity is defined as the ratio of total displacement to total time taken. It is a vector quantity and depends on the net displacement, not on the total distance travelled.

$$\text{Average Velocity} = \frac{\text{Displacement}}{\text{Time}}$$

For circular motion, displacement is the shortest straight-line distance between the initial and final positions.

Step 1: Determine the displacement after half a revolution.

When the body completes half a revolution, it reaches the diametrically opposite point of the

circle.

Hence, the displacement is equal to the diameter:

$$\text{Displacement} = 2r$$

Step 2: Calculate the time taken for half a revolution.

The distance travelled during half a revolution is the semicircular arc:

$$\text{Distance} = \pi r$$

Since speed is constant and equal to v,

$$\text{Time} = \frac{\pi r}{v}$$

Step 3: Find the average velocity.

$$\text{Average Velocity} = \frac{2r}{\pi r/v} = \frac{2rv}{\pi r} = \frac{2v}{\pi}$$

Therefore,

$$\boxed{\text{Average Velocity} = \frac{2v}{\pi}}$$

Hence, the correct option is $\boxed{(A)}$.

Quick Tip: In circular motion, average speed depends on total distance travelled, whereas average velocity depends only on displacement. After half a revolution, displacement equals the diameter of the circle.

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2. Which of the following is the most electronegative element?

(A) Fluorine

(B) Chlorine

(C) Oxygen

(D) Nitrogen

Correct Answer: (A) Fluorine

Solution:

Concept: Electronegativity is the tendency of an atom to attract the shared pair of electrons towards itself in a chemical bond.

General periodic trend:

- Electronegativity increases from left to right across a period.
- Electronegativity decreases from top to bottom in a group.

Step 1: Compare the given elements.

The elements provided are:

$$F,\ Cl,\ O,\ N$$

Among these, fluorine lies at the top-right corner of the periodic table (excluding noble gases).

Step 2: Recall electronegativity values.

Approximate Pauling electronegativities:

$$F = 3.98$$

$$O = 3.44$$

$$Cl = 3.16$$

$$N = 3.04$$

Since fluorine has the highest value, it attracts bonding electrons most strongly.

Step 3: Conclude the answer.

Therefore, the most electronegative element is

$$\boxed{\text{Fluorine}}$$

Hence, the correct option is $\boxed{(A)}$.

Quick Tip: Fluorine is the most electronegative element in the periodic table and is often asked in competitive examinations.

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3. If α and β are the roots of $x^2-5x+6=0$, the value of $\alpha^2+\beta^2$ is:

(A) 13

(B) 25

(C) 10

(D) 15

Correct Answer: (A) 13

Solution:

Concept: For a quadratic equation

$$ax^2+bx+c=0$$

with roots α and β,

$$\alpha+\beta=-\frac{b}{a}$$

and

$$\alpha\beta=\frac{c}{a}$$

Also,

$$\alpha^2+\beta^2=(\alpha+\beta)^2-2\alpha\beta$$

Step 1: Find the sum and product of roots.

Given:

$$x^2-5x+6=0$$

Thus,

$$\alpha + \beta = 5$$

and

$$\alpha\beta = 6$$

Step 2: Apply the identity.

$$\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta$$

Substituting values:

$$= (5)^2 - 2(6)$$

$$= 25 - 12$$

$$= 13$$

Step 3: Write the final answer.

$$\boxed{\alpha^2 + \beta^2 = 13}$$

Hence, the correct option is $\boxed{(A)}$.

Quick Tip: Remember the identity:

$$\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta$$

It is frequently used in questions involving roots of quadratic equations.

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4. The focal length of a concave mirror is 20 cm. The distance at which an object should be placed to get a real image of same size is:

(A) 10 cm

(B) 20 cm

(C) 40 cm

(D) 30 cm

Correct Answer: (C) 40 cm

Solution:

Concept: A concave mirror forms a real image of the same size as the object when the object is placed at the center of curvature.
The center of curvature is located at a distance equal to twice the focal length from the pole of the mirror.

$$C = 2f$$

At this position:

- The image formed is real.
- The image is inverted.
- The image is of the same size as the object.
- The image is formed at the center of curvature itself.

Step 1: Identify the given focal length.
The focal length is

$$f = 20 \text{ cm}$$

Step 2: Calculate the center of curvature.
Since

$$C = 2f$$

we get

$$C = 2 \times 20$$

$$C = 40 \text{ cm}$$

Step 3: Determine the required object position.

To obtain a real image of the same size as the object, the object must be placed at the center of curvature.

Therefore,

$$\boxed{\text{Object distance} = 40 \text{ cm}}$$

Hence, the correct option is $\boxed{(C)}$.

Quick Tip: For a concave mirror:

$$\text{Same-size real image} \Rightarrow \text{Object at } C = 2f$$

This is one of the most important standard ray-diagram results.

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5. What is the common name of CH_3COOH?

(A) Acetic acid

(B) Formic acid

(C) Oxalic acid

(D) Citric acid

Correct Answer: (A) Acetic acid

Solution:

Concept: Organic compounds often have both an IUPAC name and a common name.

The compound

$$CH_3COOH$$

belongs to the carboxylic acid family because it contains the functional group

$$-COOH$$

The IUPAC name of CH_3COOH is **ethanoic acid**, while its common name is **acetic acid**.

Step 1: Identify the functional group.

The structure is

$$CH_3 - COOH$$

which contains the carboxyl group ($-COOH$).

Therefore, it is a carboxylic acid.

Step 2: Determine the carbon chain length.

The molecule contains two carbon atoms.

Hence, according to IUPAC nomenclature, the name is

Ethanoic Acid

Step 3: Recall the common name.

Ethanoic acid is commonly known as

$$\boxed{\text{Acetic Acid}}$$

It is the principal acidic component of vinegar.

Therefore, the correct option is $\boxed{(A)}$.

Quick Tip: Important common names:

$HCOOH \rightarrow$ Formic Acid

$CH_3COOH \rightarrow$ Acetic Acid

These are frequently asked in chemistry examinations.

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6. The value of $\sin^2 30^\circ + \cos^2 30^\circ$ is:

(A) 1

(B) 0

(C) 0.5

(D) $\sqrt{3}$

Correct Answer: (A) 1

Solution:

Concept: One of the fundamental identities in trigonometry is the Pythagorean identity:

$$\sin^2\theta + \cos^2\theta = 1$$

This identity is true for every value of θ.

Step 1: Substitute $\theta = 30^\circ$.

Using the identity directly,

$$\sin^2 30^\circ + \cos^2 30^\circ = 1$$

Thus the answer is immediately obtained.

Step 2: Verify using standard trigonometric values.

We know that

$$\sin 30^\circ = \frac{1}{2}$$

and

$$\cos 30^\circ = \frac{\sqrt{3}}{2}$$

Therefore,

$$\sin^2 30^\circ = \left(\frac{1}{2}\right)^2 = \frac{1}{4}$$

and

$$\cos^2 30^\circ = \left(\frac{\sqrt{3}}{2}\right)^2 = \frac{3}{4}$$

Adding them,

$$\frac{1}{4} + \frac{3}{4} = \frac{4}{4} = 1$$

Step 3: State the final result.

$$\boxed{\sin^2 30^\circ + \cos^2 30^\circ = 1}$$

Hence, the correct option is $\boxed{(A)}$.

Quick Tip: Always remember the identity:

$$\sin^2\theta + \cos^2\theta = 1$$

It is one of the most frequently used formulas in trigonometry.

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7. A current of 5 A flows through a wire for 10 minutes. The total charge passed is:

(A) 500 C

(B) 50 C

(C) 300 C

(D) 3000 C

Correct Answer: (D) 3000 C

Solution:

Concept: Electric current is defined as the rate of flow of electric charge through a conductor. Mathematically,

$$I = \frac{Q}{t}$$

where

- I = current (ampere)
- Q = charge (coulomb)
- t = time (second)

Rearranging the formula,

$$Q = It$$

This relation is used to calculate the amount of charge flowing through a conductor when current and time are known.

Step 1: Write the given data.

Current flowing through the wire:

$$I = 5A$$

Time:

$$t = 10 \text{ minutes}$$

Since SI units require time in seconds,

$$t = 10 \times 60 = 600 \text{ s}$$

Step 2: Apply the formula $Q = It$.

Substituting the values,

$$Q = (5)(600)$$

$$Q = 3000$$

$$Q = 3000\,C$$

Step 3: State the result.

Hence, the total charge passing through the wire is

$$\boxed{3000\,C}$$

Therefore, the correct option is $\boxed{(D)}$.

Quick Tip: Remember the basic relation:

$$Q = It$$

One ampere means one coulomb of charge flows per second.

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8. Which gas is liberated when an acid reacts with a metal?

(A) Hydrogen

(B) Oxygen

(C) Carbon dioxide

(D) Nitrogen

Correct Answer: (A) Hydrogen

Solution:

Concept: Metals react with dilute acids to form a salt and hydrogen gas.

The general reaction is

$$\text{Metal} + \text{Acid} \rightarrow \text{Salt} + H_2 \uparrow$$

The upward arrow indicates the evolution of a gas.

Step 1: Recall a common reaction.

For example, zinc reacts with hydrochloric acid as follows:

$$Zn + 2HCl \rightarrow ZnCl_2 + H_2$$

Hydrogen gas is released during the reaction.

Step 2: Consider another example.

Magnesium reacts with dilute sulphuric acid:

$$Mg + H_2SO_4 \rightarrow MgSO_4 + H_2$$

Again, hydrogen gas is evolved.

Step 3: Identify the liberated gas.

In general, active metals displace hydrogen from acids.

Therefore, the gas produced is

$$\boxed{\text{Hydrogen}}$$

Hence, the correct option is $\boxed{(A)}$.

Quick Tip: Metal + Dilute Acid → Salt + Hydrogen Gas

Hydrogen can be identified by the characteristic "pop" sound when a burning splint is brought near it.

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9. The sum of the first 10 terms of an AP with $a = 2$ and $d = 3$ is:

(A) 155

(B) 145

(C) 165

(D) 150

Correct Answer: (A) 155

Solution:

Concept: The sum of the first n terms of an arithmetic progression (A.P.) is given by

$$S_n = \frac{n}{2}[2a + (n-1)d]$$

where

- a = first term
- d = common difference
- n = number of terms

Step 1: Write the given values.

$$a = 2, \qquad d = 3, \qquad n = 10$$

Step 2: Substitute into the sum formula.

$$S_{10} = \frac{10}{2}[2(2) + (10-1)(3)]$$

$$= 5[4 + 27]$$

$$= 5(31)$$

$$= 155$$

Step 3: Verify by listing the terms.

The first ten terms are

$$2,\ 5,\ 8,\ 11,\ 14,\ 17,\ 20,\ 23,\ 26,\ 29$$

Adding them also gives

$$155$$

Therefore,

$$\boxed{S_{10} = 155}$$

Hence, the correct option is $\boxed{(A)}$.

Quick Tip: For AP problems involving sums, memorize:

$$S_n = \frac{n}{2}[2a + (n-1)d]$$

It is one of the most frequently used formulas in sequences and series.

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10. An object of 10 kg at a height of 5 m has potential energy ($g = 9.8\, m/s^2$):

(A) 49 J

(B) 500 J

(C) 490 J

(D) 980 J

Correct Answer: (C) 490 J

Solution:

Concept: Potential energy is the energy possessed by an object due to its position or configuration. Gravitational potential energy depends on the mass of the object, the acceleration due to

gravity, and the height above a reference level.

The formula is

$$PE = mgh$$

where

- m = mass of the object
- g = acceleration due to gravity
- h = height above the reference level

Step 1: Write the given values.

$$m = 10\,kg$$

$$g = 9.8\,m/s^2$$

$$h = 5\,m$$

Step 2: Substitute into the formula.

$$PE = mgh$$

$$PE = 10 \times 9.8 \times 5$$

$$PE = 98 \times 5$$

$$PE = 490$$

$$PE = 490\,J$$

Step 3: State the final answer.

Therefore, the gravitational potential energy of the object is

$$\boxed{490\,J}$$

Hence, the correct option is $\boxed{(C)}$.

Quick Tip: Potential energy increases with height. If either mass or height doubles, the potential energy also doubles.

$$PE = mgh$$

is one of the most important formulas in mechanics.

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11. Which of these is a saturated hydrocarbon?

(A) Ethane

(B) Ethene

(C) Ethyne

(D) Benzene

Correct Answer: (A) Ethane

Solution:

Concept: Hydrocarbons are compounds containing only carbon and hydrogen atoms.
They are classified as:

- **Saturated hydrocarbons:** Contain only single covalent bonds between carbon atoms.
- **Unsaturated hydrocarbons:** Contain one or more double or triple bonds.

Alkanes are saturated hydrocarbons.

Step 1: Examine each option.

$$\text{Ethane} = C_2H_6$$

Ethane contains only single bonds.

$$\text{Ethene} = C_2H_4$$

Ethene contains a carbon-carbon double bond.

$$\text{Ethyne} = C_2H_2$$

Ethyne contains a carbon-carbon triple bond.

$$\text{Benzene} = C_6H_6$$

Benzene contains alternating double bonds in a ring structure.

Step 2: Identify the saturated hydrocarbon.

Among the given compounds, only ethane has all single bonds.

Therefore, it is a saturated hydrocarbon.

$$\boxed{\text{Ethane}}$$

Step 3: Conclude the answer.

Hence, the correct option is $\boxed{(A)}$.

Quick Tip: Remember:

$$\text{Alkanes} \rightarrow \text{Saturated}$$

$$\text{Alkenes and Alkynes} \rightarrow \text{Unsaturated}$$

Ethane is an alkane and therefore saturated.

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12. If the radius of a circle is doubled, its area becomes:

(A) Four times

(B) Double

(C) Eight times

(D) Remains same

Correct Answer: (A) Four times

Solution:

Concept: The area of a circle is directly proportional to the square of its radius.

The formula for the area of a circle is

$$A = \pi r^2$$

where r is the radius.

Step 1: Write the original area.

If the original radius is r, then

$$A = \pi r^2$$

Step 2: Double the radius.

The new radius is

$$r' = 2r$$

The new area becomes

$$A' = \pi(2r)^2$$

$$A' = \pi(4r^2)$$

$$A' = 4\pi r^2$$

Step 3: Compare the two areas.

Since

$$A = \pi r^2$$

and

$$A' = 4\pi r^2$$

therefore

$$A' = 4A$$

Thus, the new area is four times the original area.

$$\boxed{\text{Area becomes four times}}$$

Hence, the correct option is $\boxed{(A)}$.

Quick Tip: Whenever a quantity depends on the square of a variable:

$$(x \to 2x)$$

implies

$$x^2 \to 4x^2$$

Since area of a circle depends on r^2, doubling the radius quadruples the area.

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13. The SI unit of power is:

(A) Watt

(B) Joule

(C) Newton

(D) Pascal

Correct Answer: (A) Watt

Solution:

Concept: Power is defined as the rate at which work is done or energy is transferred.

Mathematically,

$$P = \frac{W}{t}$$

where

- P = Power
- W = Work done
- t = Time taken

The SI unit of work is Joule (J) and the SI unit of time is second (s).

Therefore,

$$\text{SI unit of Power} = \frac{\text{Joule}}{\text{second}}$$

This unit is called the **Watt**.

Step 1: Recall the definition of power.

Power measures how quickly work is performed.

A machine doing the same amount of work in less time has greater power.

Step 2: Determine the SI unit.

Since

$$1\,W = 1\,\frac{J}{s}$$

the SI unit of power is Watt.

Step 3: Check the remaining options.

- Joule is the SI unit of work and energy.
- Newton is the SI unit of force.
- Pascal is the SI unit of pressure.

Thus, only Watt represents power.

$$\boxed{\text{SI unit of Power} = \text{Watt}}$$

Hence, the correct option is $\boxed{(A)}$.

Quick Tip: Remember these common SI units:

Work → Joule

Power → Watt

Force → Newton

Pressure → Pascal

14. Which non-metal is liquid at room temperature?

(A) Mercury

(B) Bromine

(C) Iodine

(D) Carbon

Correct Answer: (B) Bromine

Solution:

Concept: Matter exists in different physical states such as solid, liquid, and gas. Most non-metals are either solids or gases at room temperature.
An important exception is bromine, which exists as a reddish-brown liquid under normal conditions.

Step 1: Analyze each option.

- Bromine (Br_2) is a liquid non-metal.
- Mercury (Hg) is a liquid metal, not a non-metal.
- Iodine (I_2) is a solid non-metal.
- Carbon is a solid non-metal.

Step 2: Identify the liquid non-metal.

Among all the options, bromine is the only non-metal that remains liquid at room temperature.

$$\boxed{\text{Bromine}}$$

Step 3: State the conclusion.

Therefore, the non-metal that is liquid at room temperature is bromine.

Hence, the correct option is $\boxed{(B)}$.

Quick Tip: A frequently asked fact:

- Bromine is the only liquid non-metal at room temperature.
- Mercury is a liquid metal.

Do not confuse these two elements.

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15. Probability of getting a number > 4 on a fair die is:

(A) $\frac{1}{2}$

(B) $\frac{1}{3}$

(C) $\frac{1}{6}$

(D) $\frac{2}{3}$

Correct Answer: (B) $\frac{1}{3}$

Solution:

Concept: Probability measures the likelihood of occurrence of an event.

For equally likely outcomes,

$$P(E) = \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}}$$

where $P(E)$ denotes the probability of event E.

Step 1: List the outcomes of a fair die.

A fair die has six possible outcomes:

$$\{1, 2, 3, 4, 5, 6\}$$

Therefore,

$$\text{Total outcomes} = 6$$

Step 2: Determine the favourable outcomes.

The event is obtaining a number greater than 4.

The favourable outcomes are:

$$\{5, 6\}$$

Thus,

$$\text{Number of favourable outcomes} = 2$$

Step 3: Apply the probability formula.

$$P(\text{number} > 4) = \frac{2}{6}$$

$$= \frac{1}{3}$$

Step 4: State the final answer.

Hence,

$$\boxed{\frac{1}{3}}$$

is the required probability.

Therefore, the correct option is $\boxed{(B)}$.

Quick Tip: For a fair die:

$$P(E) = \frac{\text{Favourable Outcomes}}{6}$$

Always count the outcomes carefully before applying the probability formula.