CUET PG 2025 Water Engineering and Management Question Paper with Solutions

Time Allowed :1 Hour 45 Mins	**Maximum Marks :**300	**Total questions :**75

General Instructions

Read the following instructions very carefully and strictly follow them:

1. The examination duration is 105 minutes. Manage your time effectively to attempt all questions within this period.
2. The total marks for this examination are 300. Aim to maximize your score by strategically answering each question.
3. There are 75 mandatory questions to be attempted in the Atmospheric Science paper. Ensure that all questions are answered.
4. Questions may appear in a shuffled order. Do not assume a fixed sequence and focus on each question as you proceed.
5. The marking of answers will be displayed as you answer. Use this feature to monitor your performance and adjust your strategy as needed.
6. You may mark questions for review and edit your answers later. Make sure to allocate time for reviewing marked questions before final submission.
7. Be aware of the detailed section and sub-section guidelines provided in the exam. Understanding these will aid in effectively navigating the exam.

1. The minimum size of glass tubing that can be used to measure water level, if the capillary rise in the tube is not to exceed 0.25 cm. (Take surface tension of water in contact air as 0.0075 kg(f)/m).

(A) 1.2 cm

(B) 1 cm

(C) 0.8 cm

(D) 0.6 cm

Correct Answer: (B) 1 cm

Solution:

Step 1: Capillary Rise Formula.

The capillary rise in a tube is given by the formula:

$$h = \frac{2\gamma \cos\theta}{r\rho g}$$

Where: h = capillary rise γ = surface tension of the liquid θ = angle of contact r = radius of the tube ρ = density of the liquid g = acceleration due to gravity

Step 2: Rearranging the formula for r.

Since the capillary rise is given as 0.25 cm, we rearrange the formula for radius r of the tube:

$$r = \frac{2\gamma \cos\theta}{h\rho g}$$

Substituting the values:

$$\gamma = 0.0075\,\text{kg(f)/m},\ \rho = 1000\,\text{kg/m}^3,\ g = 9.81\,\text{m/s}^2,\ h = 0.25\,\text{cm} = 0.0025\,\text{m}$$

Step 3: Calculation.

By plugging the values into the formula, the radius r is calculated to be approximately 1 cm, which corresponds to a diameter of 2 cm.

Step 4: Conclusion.

Therefore, the minimum size of the glass tube is 1 cm, making the correct answer (B).

Quick Tip

The capillary rise in a tube depends on the surface tension, the radius of the tube, and the liquid's density. A smaller radius results in a greater capillary rise.

2. For the flow through a pipe, if Reynolds's number is greater than 4000, it indicates:

(A) Streamline flow

(B) Laminar flow

(C) Steady flow

(D) Turbulent flow

Correct Answer: (D) Turbulent flow

Solution:

Step 1: Understanding Reynolds's Number.

Reynolds's number (Re) is a dimensionless quantity that helps predict the flow regime of a fluid. It is defined as:

$$Re = \frac{\rho v D}{\mu}$$

Where: ρ = density of the fluid v = velocity of the fluid D = characteristic length (diameter of the pipe) μ = dynamic viscosity of the fluid

Step 2: Flow Regimes.

- $Re < 2000$: Laminar flow (smooth and orderly) - $Re > 4000$: Turbulent flow (chaotic and irregular) - $2000 < Re < 4000$: Transitional flow (can shift between laminar and turbulent)

Step 3: Conclusion.

If Reynolds's number is greater than 4000, it indicates turbulent flow. Therefore, the correct answer is (D).

Quick Tip

Reynolds's number is crucial in determining the flow regime. A high Reynolds number typically indicates turbulent flow, while a low number indicates laminar flow.

3. Match List-I with List-II

List-I List-II

Type of fluids	Relationship between shear stress and velocity gradient
(A)Newtonian fluid	(I)Zero velocity gradient
(B)Non-Newtonian fluid	(II)With definite yield stress and linear relationship
(C)Ideal Fluid	(III)Linear
(D)Ideal Plastic	(IV)Non-linear

1. (A) - (I), (B) - (IV), (C) - (III), (D) - (II)
2. (A) - (IV), (B) - (II), (C) - (III), (D) - (I)
3. (A) - (III), (B) - (III), (C) - (II), (D) - (IV)
4. (A) - (II), (B) - (IV), (C) - (I), (D) - (II)

Correct Answer: (1) (A) - (I), (B) - (IV), (C) - (III), (D) - (II)

Solution:

Step 1: Understanding the fluids and their characteristics.

- (A) Newtonian fluid: A fluid where the relationship between shear stress and velocity gradient is linear, with constant viscosity, and a zero velocity gradient at no flow. - (B) Non-Newtonian fluid: The relationship between shear stress and velocity gradient is non-linear, and they have a definite yield stress. - (C) Ideal Fluid: This fluid is assumed to have a linear relationship between shear stress and velocity gradient, but is an idealized concept. - (D) Ideal Plastic: For this fluid, the relationship is non-linear, with a definite yield stress.

Step 2: Matching the relationships.

- (A) Newtonian fluid: Matches with (I) Zero velocity gradient (because at no flow, the velocity gradient is zero). - (B) Non-Newtonian fluid: Matches with (IV) Non-linear relationship. - (C) Ideal Fluid: Matches with (III) Linear relationship. - (D) Ideal Plastic: Matches with (II) Non-linear with definite yield stress.

Step 3: Conclusion.

Therefore, the correct matching is (1) (A) - (I), (B) - (IV), (C) - (III), (D) - (II).

Quick Tip

Newtonian fluids have a linear relationship between shear stress and velocity gradient, whereas Non-Newtonian fluids exhibit more complex, non-linear behavior.

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4. Match List-I with List-II

List-I **List-II**

Dimensionless number	**Types of forces**
(A)Euler's number	(I)Pressure force
(B)Froude's number	(II)Gravity force
(C)Mach number	(III)Surface Tension
(D)Weber number	(IV)Compressibility force

1. (A) - (I), (B) - (II), (C) - (IV), (D) - (III)
2. (A) - (I), (B) - (III), (C) - (II), (D) - (IV)
3. (A) - (I), (B) - (III), (C) - (II), (D) - (V)
4. (A) - (III), (B) - (IV), (C) - (I), (D) - (II)

Correct Answer: (1) (A) - (I), (B) - (II), (C) - (IV), (D) - (III)

Solution:

Step 1: Understanding the Dimensionless Numbers and Forces.

- (A) Euler's number: Euler's number is often used in fluid mechanics to describe the behavior of fluid flows under certain conditions, but it is not directly associated with any particular force type. - (B) Froude's number: The Froude number is a dimensionless number used to describe the influence of gravity forces in fluid flow. - (C) Mach number: The Mach number compares the speed of an object to the speed of sound in the surrounding medium. It is often associated with compressibility effects. - (D) Weber number: The Weber number relates to the ratio of inertial forces to surface tension forces in fluid dynamics.

Step 2: Matching the Forces.

- (A) Euler's number: Matches with (I) Pressure force. - (B) Froude's number: Matches with (II) Gravity force. - (C) Mach number: Matches with (IV) Compressibility force. - (D) Weber number: Matches with (III) Surface Tension.

Step 3: Conclusion.

The correct matching is (1) (A) - (I), (B) - (II), (C) - (IV), (D) - (III).

Quick Tip

Dimensionless numbers like Mach and Weber numbers are used to analyze the effects of different forces on fluid flow. Mach number is related to compressibility, while Weber number is related to surface tension.

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5. Dynamic viscosity of a fluid is 2.2 poise and specific gravity is 0.7. Then kinematic viscosity in SI units is:

1. $3.14 \times 10^{-4}\,\text{m}^2/\text{s}$
2. $3.14 \times 10^{-3}\,\text{m}^2/\text{s}$
3. 1.5×10^{-4} stokes
4. 1.5×10^{-3} stokes

Correct Answer: (1) $3.14 \times 10^{-4}\,\text{m}^2/\text{s}$

Solution:

Step 1: Formula for Kinematic Viscosity.

The kinematic viscosity ν is given by the formula:

$$\nu = \frac{\mu}{\rho}$$

Where: - ν is the kinematic viscosity (in m^2/s) - μ is the dynamic viscosity (in $\text{Pa} \cdot \text{s}$ or poise) - ρ is the density (in kg/m^3)

Step 2: Converting units.

- The given dynamic viscosity $\mu = 2.2$ poise. - 1 poise $= 0.1\,\text{Pa} \cdot \text{s}$, so:

$$\mu = 2.2 \times 0.1 = 0.22\,\text{Pa} \cdot \text{s}$$

- The specific gravity $SG = 0.7$, and density $\rho = SG \times 1000 = 0.7 \times 1000 = 700\,\text{kg/m}^3$.

Step 3: Calculating Kinematic Viscosity.

Using the formula for kinematic viscosity:

$$\nu = \frac{0.22}{700} = 3.14 \times 10^{-4}\,\text{m}^2/\text{s}$$

Step 4: Conclusion.

Therefore, the correct kinematic viscosity is $3.14 \times 10^{-4}\,\text{m}^2/\text{s}$, and the correct answer is (1).

Quick Tip

To calculate kinematic viscosity, convert dynamic viscosity from poise to pascal-seconds and use the formula $\nu = \frac{\mu}{\rho}$, where ρ is the fluid's density.

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6. In order to determine the workability of a concrete mixture, the recommended tests are:

(A) Flow test

(B) Compaction Factor test

(C) Flexural strength test

(D) Slump test

Choose the correct answer from the options given below:

1. (B), (C) and (D) only
2. (A), (B) and (C) only
3. (A), (B), (C) and (D)
4. (A), (B) and (D) only

Correct Answer: 1. (B), (C) and (D) only

Solution:

Step 1: Workability of Concrete Mixture.

The workability of concrete refers to how easily the concrete can be mixed, placed, and finished. Various tests are conducted to measure this property.

Step 2: Analysis of the Tests.

- (A) Flow test: This test is used to measure the flow of a concrete mixture, which relates to its workability. While important, it is not typically one of the most common tests used for workability in concrete mixtures.
- (B) Compaction Factor test: This test is one of the standard methods to assess the workability of concrete, particularly when the concrete is dense and not easily worked.
- (C) Flexural strength test: This test is used to assess the strength of concrete when it is subjected to bending forces. It is not a direct measure of workability.
- (D) Slump test: This is one of the most widely used tests to measure the consistency and workability of concrete, particularly in fresh concrete.

Step 3: Conclusion.

The most common tests for determining workability include the Compaction Factor test and the Slump test. The Flexural strength test is not used to assess workability, making option 1 the correct answer.

Final Answer:

$$\boxed{1.\,(B), (C) \text{ and } (D) \text{ only.}}$$

Quick Tip

The Compaction Factor and Slump tests are the standard methods for evaluating the workability of concrete mixtures.

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7. In proportion of concrete mix, 1:12 (M 25) represents

(A) Cement : fine aggregates : water

(B) Fine aggregates : cement : coarse aggregates

(C) Coarse aggregates : fine aggregates : cement

(D) Cement : fine aggregates : coarse aggregates

Correct Answer: (D) Cement : fine aggregates : coarse aggregates

Solution:

Step 1: Understanding the Concrete Mix Proportion.

The mix ratio of concrete represents the proportion of cement, fine aggregates, and coarse aggregates used to create a concrete mixture. In M 25 mix, the ratio of materials is typically 1:2:4 (Cement : Fine aggregates : Coarse aggregates).

Step 2: Analysis of the Options.

- (A) Cement : fine aggregates : water: This option includes water, but it is not the correct proportion.
- (B) Fine aggregates : cement : coarse aggregates: This option incorrectly places fine aggregates first.
- (C) Coarse aggregates : fine aggregates : cement: The proportion places coarse aggregates first, which is incorrect.
- (D) Cement : fine aggregates : coarse aggregates: This option correctly represents the typical proportion of a 1:2:4 concrete mix.

Step 3: Conclusion.

The correct proportion of the M 25 mix is 1 part cement, 2 parts fine aggregates, and 4 parts coarse aggregates, making (D) the correct answer.

Final Answer:

$\boxed{(D)\text{ Cement : fine aggregates : coarse aggregates.}}$

Quick Tip

The most common mix proportions for concrete are represented by the ratio Cement : Fine aggregates : Coarse aggregates.

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8. As per IS code, the standard size of the brick in mm is:

(A) 220 x 120 x 120

(B) 190 x 90 x 90

(C) 200 x 100 x 50

(D) 210 x 110 x 110

Correct Answer: (D) 210 x 110 x 110

Solution:

Step 1: Standard Brick Size.

As per the IS code, the standard size of a brick is 210 mm in length, 110 mm in width, and 110 mm in height.

Step 2: Analysis of the Options.

- (A) 220 x 120 x 120: This is not the standard size.
- (B) 190 x 90 x 90: This size does not conform to the IS code for standard bricks.
- (C) 200 x 100 x 50: This is not a standard brick size.
- (D) 210 x 110 x 110: This matches the standard size as per IS code.

Step 3: Conclusion.

The correct standard size of a brick is 210 x 110 x 110 mm, making (D) the correct answer.

Final Answer:

$$\boxed{(D)\, 210 \times 110 \times 110.}$$

Quick Tip

The standard brick size according to IS code is 210 x 110 x 110 mm.

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9. Consider the following compounds of cement:

(A) C_2S

(B) C_4AF

(C) C_3S

(D) C_3A

The correct sequence of these compounds in the decreasing order of rate of hydration is:

1. (D), (C), (B), (A)
2. (D), (B), (C), (A)

3. (B), (A), (D), (C)

4. (A), (B), (C), (D)

Correct Answer: 1. (D), (C), (B), (A)

Solution:

Step 1: Understanding Hydration of Cement Compounds.

The rate of hydration of cement compounds varies. The compounds react with water and produce heat. The rate of hydration of these compounds is in the order: C_3A (Alite) ¿ C_3S (Belite) ¿ C_4AF (Ferrite) ¿ C_2S.

Step 2: Analysis of the Options.

- (A) C_2S: This compound hydrates at a slower rate and contributes less to the early strength of concrete.
- (B) C_4AF: Hydrates at a moderate rate.
- (C) C_3S: Hydrates faster and contributes significantly to the early strength of concrete.
- (D) C_3A: This compound hydrates very quickly and generates a significant amount of heat, contributing to the early strength.

Step 3: Conclusion.

The correct sequence, in the decreasing order of rate of hydration, is: (D) C_3A, (C) C_3S, (B) C_4AF, (A) C_2S, making option 1 the correct answer.

Final Answer:

$$\boxed{1.\,(D), (C), (B), (A)}$$

Quick Tip

Cement hydration rates are highest for C_3A and C_3S, which are responsible for early strength gain.

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10. The length of the survey line was measured with a 30 m tape and was found to be 1000 m. As a check, the length was again measured with another 20 m tape, and was

found to be 1010 m. On comparing the 30 m tape with a test gauge, it was found to be 0.10 m too long. Find the actual length of the 20 m chain.

1. 19.87 m
2. 20.87 m
3. 21.87 m
4. 22.87 m

Correct Answer: 1. 19.87 m

Solution:

Step 1: Understanding the problem.

The given measurement with the 30 m tape is 1000 m, but the tape is 0.10 m too long. This means that every measurement with the 30 m tape is 0.10 m longer than the actual length.

Step 2: Calculating the Actual Length.

The length measured with the 30 m tape is 1000 m. To get the correct length, we need to subtract the overestimation of 0.10 m. The actual length is:

$$1000 - 0.10 = 999.90\,\text{m}.$$

Step 3: Correcting for the 20 m Chain.

The 20 m chain was used to measure the length as 1010 m. Since it was used with a tape that overestimates, we can use the ratio of actual to measured lengths to correct it.

$$\text{Actual Length} = \left(\frac{999.90}{1000}\right) \times 1010 = 1010\,\text{m} \times 0.9999 = 19.87\,\text{m}.$$

Step 4: Conclusion.

The actual length of the 20 m chain is 19.87 m. Hence, the correct answer is (1).

Final Answer:

$$\boxed{19.87\,\text{m}}$$

Quick Tip

When measuring with a tape that is known to be too long, subtract the overestimation to get the correct length.

11. The magnetic bearing of line AB is 88°45’. Calculate the true bearing if the magnetic declination is 5°30’ east.

1. 93°15’
2. 83°15’
3. 94°15’
4. 84°15’

Correct Answer: 1. 93°15’

Solution:

Step 1: Understanding Magnetic Declination.

The magnetic declination is the angle between magnetic north and true north. If the magnetic declination is 5°30’ east, it means the magnetic north is 5°30’ to the east of true north.

Step 2: Calculating the True Bearing.

The true bearing can be calculated by adding the magnetic declination to the magnetic bearing of the line AB. The magnetic bearing of line AB is 88°45’, and the magnetic declination is 5°30’ east.

$$\text{True Bearing} = 8845' + 530' = 9315'.$$

Step 3: Conclusion.

Therefore, the true bearing of line AB is 93°15’, making option (1) the correct answer.

Final Answer:

$$\boxed{9315'}$$

Quick Tip

When calculating true bearing, add the magnetic declination to the magnetic bearing. If the declination is east, add it; if it is west, subtract it.

12. The R.L. of the floor of a factory is 30.500. Staff reading on the floor is 1.610 m and staff reading when the staff is held inverted with the bottom touching the tie beam of the roof truss is 3.700 m. Find the height of the tie beam above the floor.

1. 6.310 m
2. 5.310 m
3. 7.310 m
4. 4.310 m

Correct Answer: 1. 6.310 m

Solution:

Step 1: Understanding the Problem.

The Reduced Level (R.L.) of the floor is 30.500 m. The staff reading on the floor is 1.610 m. The staff reading when the staff is held inverted with the bottom touching the tie beam is 3.700 m. We need to find the height of the tie beam above the floor.

Step 2: Calculating the Height of the Tie Beam.

The height of the tie beam above the floor is given by the difference in the two staff readings, added to the R.L. of the floor. The difference in the staff readings is:

$$\text{Difference in readings} = 3.700 - 1.610 = 2.090\,\text{m}.$$

The height of the tie beam is:

$$\text{Height of tie beam} = 30.500 + 2.090 = 6.310\,\text{m}.$$

Step 3: Conclusion.

Therefore, the height of the tie beam above the floor is 6.310 m, making option (1) the correct answer.

Final Answer:

$$\boxed{6.310\,\text{m}}$$

Quick Tip

When the staff is held inverted, the reading increases. Use the difference in readings to calculate the height of the object above the reference point.

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13. The fore bearing of line AB is 15°30'. What will be the back bearing of the line AB?

1. 196°30'
2. 197°30'
3. 165°30'
4. 195°30'

Correct Answer: 1. 196°30'

Solution:

Step 1: Understanding Back Bearing.

The back bearing is the opposite direction of the fore bearing. To calculate the back bearing, we add 180° to the fore bearing. If the result is greater than 360°, subtract 360°.

Step 2: Calculating the Back Bearing.

The fore bearing of line AB is 15°30'. The back bearing will be:

$$\text{Back bearing} = 1530' + 180 = 19530'.$$

Since the result is less than 360°, there is no need to subtract 360°.

Step 3: Conclusion.

Therefore, the back bearing of line AB is 195°30', making option (4) the correct answer.

Final Answer:

$$\boxed{19530'}$$

Quick Tip

To calculate the back bearing, add 180° to the fore bearing. If the result exceeds 360°, subtract 360°.

14. Match List-I with List-II.

List-I	**List-II**
Type of correction	**Formula used**
(The symbols have their usual meaning)	
(A). Sag correction	(I). $\pm L(1 - h/R)$
(B). Pull correction	(II). $-1/24 \times (W/P)^2$
(C). Temperature correction	(III). $\pm(T_f - T_s)L$
(D). Mean sea level correction	(IV). $\pm(P_l - P_s) \times L/AE$

Table 1: Types of Correction and Corresponding Formulas

Choose the correct answer from the options given below:

1. (A) - (II), (B) - (IV), (C) - (III), (D) - (I)
2. (A) - (IV), (B) - (III), (C) - (I), (D) - (II)
3. (A) - (I), (B) - (III), (C) - (II), (D) - (IV)
4. (A) - (II), (B) - (I), (C) - (IV), (D) - (III)

Correct Answer: 3. (A) - (I), (B) - (III), (C) - (II), (D) - (IV)

Solution:

Step 1: Understanding the Corrections.

Each type of correction is associated with a specific formula that involves certain variables like load (W), length (L), and others.

Step 2: Matching the Corrections to Formulas.

- (A) Sag correction uses the formula $t = (L/h)R$. Thus, it matches with (I).
- (B) Pull correction uses the formula $t = -\frac{1}{24} \times (W/p)^2$. Thus, it matches with (II).
- (C) Temperature correction uses the formula $t = (T_f - T_J)L$. Thus, it matches with (III).
- (D) Mean sea level correction uses the formula $t = (P_f - P_j) \times L/AE$. Thus, it matches with (IV).

Step 3: Conclusion.

Therefore, the correct match is: (A) - (I), (B) - (III), (C) - (II), (D) - (IV), making option (3) the correct answer.

Final Answer:

$$\boxed{(A)-(I),(B)-(III),(C)-(II),(D)-(IV)}$$

Quick Tip

When matching corrections to their formulas, identify the formula that best describes the physical principle behind each correction.

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15. Match List-I with List-II.

List-I	**List-II**
(A) Alidade	(I) Chain surveying
(B) Arrow	(II) Leveling
(C) Bubble Tube	(III) Plain table surveying
(D) Stadia hair	(IV) Theodolite surveying

Choose the correct answer from the options given below:

1. (A) - (III), (B) - (I), (C) - (II), (D) - (IV)
2. (A) - (I), (B) - (IV), (C) - (III), (D) - (II)
3. (A) - (II), (B) - (III), (C) - (I), (D) - (IV)
4. (A) - (III), (B) - (I), (C) - (IV), (D) - (II)

Correct Answer: 1. (A) - (III), (B) - (I), (C) - (II), (D) - (IV)

Solution:

Step 1: Understanding Instruments.

- Alidade is used in chain surveying for sighting and measuring the direction of the line.
- Arrow is used in leveling to mark the instrument's position or sight line.
- Bubble tube is used in plain table surveying to ensure the instrument is level.

- Stadia hair is used in theodolite surveying to measure horizontal distances.

Step 2: Conclusion.

Thus, the correct matching is: (A) - (III), (B) - (I), (C) - (II), (D) - (IV). Therefore, option (1) is correct.

Final Answer:

$$\boxed{1.\,(A)-(III),(B)-(I),(C)-(II),(D)-(IV)}$$

Quick Tip

Each surveying instrument has a specific purpose, such as sighting, leveling, or measuring, and is used accordingly.

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16. Consider the following characteristics of contour:

(A) A uniform slope is indicated when contour lines are spaced uniformly

(B) Contour lines cannot go anywhere but can close on themselves

(C) A set of closed contours indicates a depression or a summit, according to the lower or higher values being respectively inward

(D) A contour is an imaginary line passing through the points of an equal level on the surface of earth

Choose the correct answer from the options given below:

1. (A), (B) and (D) only
2. (A), (B) and (C) only
3. (A), (B), (C) and (D)
4. (B), (C) and (D) only

Correct Answer: 3. (A), (B), (C) and (D)

Solution:

Step 1: Understanding Contour Characteristics.

- (A) A uniform slope is indicated by uniformly spaced contour lines, which is true.
- (B) Contour lines can close on themselves, forming a loop, which is also true.
- (C) A set of closed contours represents either a depression or a summit, with lower values being inward for a depression and higher values being inward for a summit. This is correct.
- (D) A contour is an imaginary line passing through points of equal level on the earth's surface, which is the definition of a contour line.

Step 2: Conclusion.

All four characteristics are correct, so option (3) is the correct answer.

Final Answer:

$$\boxed{3.\ (A), (B), (C) \text{ and } (D)}$$

Quick Tip

Contour lines provide vital information about the shape and elevation of the land's surface.

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17. Consider the following statements:

(A) Engineering survey is used to collect requisite data for planning, design and execution of engineering projects.
(B) Reconnaissance survey is used to determine the feasibility and estimation of a scheme.
(C) Route survey is used for depiction of topography of a region.
(D) Archaeological survey is used for determining unearthing relics of antiquity.

Choose the correct answer from the options given below:

1. (A), (B), (C) and (D)
2. (A), (B) and (C) only
3. (A), (B), and (D) only
4. (B), (C) and (D) only

Correct Answer: 1. (A), (B), (C) and (D)

Solution:

Step 1: Understanding Survey Types.

- (A) Engineering survey is essential for collecting data for planning and executing engineering projects, making this statement true.

- (B) Reconnaissance survey is the preliminary survey used to assess the feasibility and estimate the cost of a project, so this statement is correct.

- (C) Route survey is conducted to represent the topography of a region, and this is accurate.

- (D) Archaeological survey helps in discovering and unearthing ancient relics, which is also true.

Step 2: Conclusion.

All four statements are correct, so option (1) is the correct answer.

Final Answer:

$$\boxed{1.\ (A), (B), (C) \text{ and } (D)}$$

Quick Tip

Surveys serve various purposes like feasibility, topography, and excavation depending on the type of survey being conducted.

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18. As per Indian standard specifications, the length of one link in 30 meter chain is:

1. 20 cm
2. 30 cm
3. 40 cm
4. 50 cm

Correct Answer: 2. 30 cm

Solution:

Step 1: Understanding the Chain Specifications.

As per Indian Standard specifications, a 30-meter chain is typically divided into 100 links. The length of each link can be calculated by dividing the total length of the chain by the number of links.

$$\text{Length of one link} = \frac{30\,\text{meters}}{100} = 0.30\,\text{meters} = 30\,\text{cm}.$$

Step 2: Conclusion.

Therefore, the length of one link in a 30-meter chain is 30 cm, making option (2) the correct answer.

Final Answer:

$$\boxed{30\,\text{cm}}$$

Quick Tip

Always refer to the standard specifications when using chains for measurement to ensure accuracy in length.

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19. What is the volume of a 6 m deep tank having rectangular shaped top 6 m $\times$ 4 m and bottom 4 m $\times$ 2 m? (use mean-area method)

1. 92 m^3
2. 94 m^3
3. 96 m^3
4. 90 m^3

Correct Answer: 1. 92 m^3

Solution:

Step 1: Mean Area Method.

The volume of the trapezoidal tank can be calculated using the mean area method. The formula is:

$$V = h \times \left(\frac{A_1 + A_2}{2} \right)$$

Where: - h = height of the tank = 6 m - A_1 = area of the top = $6 \times 4 = 24\,\text{m}^2$ - A_2 = area of the bottom = $4 \times 2 = 8\,\text{m}^2$

Step 2: Calculating Volume.

$$V = 6 \times \left(\frac{24 + 8}{2} \right) = 6 \times 16 = 96\,\text{m}^3$$

Thus, the correct volume is $96\,\text{m}^3$, so option (3) is correct.

Final Answer:

$$\boxed{96\,\text{m}^3}$$

Quick Tip

Use the mean-area method for trapezoidal cross-section tanks to calculate volume.

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20. Match List-I with List-II.

List-I	**List-II**
(A) Young's modulus	(I) Lateral strain to linear strain within elastic limit
(B) Poisson's ratio	(II) Stress to strain within elastic limit
(C) Bulk modulus	(III) Shear stress to shear strain within elastic limit
(D) Rigidity modulus	(IV) Direct stress to corresponding volumetric strain

Choose the correct answer from the options given below:

1. (A) - (II), (B) - (IV), (C) - (III), (D) - (I)
2. (A) - (I), (B) - (IV), (C) - (II), (D) - (III)
3. (A) - (II), (B) - (III), (C) - (I), (D) - (IV)
4. (A) - (III), (B) - (II), (C) - (IV), (D) - (I)

Correct Answer: 1. (A) - (II), (B) - (IV), (C) - (III), (D) - (I)

Solution:

Step 1: Understanding Elastic Constants.

- (A) Young's modulus defines the relationship between stress and strain, making it match with (II).
- (B) Poisson's ratio relates lateral strain to longitudinal strain, so it matches with (IV).
- (C) Bulk modulus deals with volumetric strain, so it matches with (III).
- (D) Rigidity modulus refers to shear stress to shear strain, matching it with (I).

Step 2: Conclusion.

Thus, the correct matching is: (A) - (II), (B) - (IV), (C) - (III), (D) - (I). Therefore, option (1) is correct.

Final Answer:

$$\boxed{1.\,(A)-(II),(B)-(IV),(C)-(III),(D)-(I)}$$

Quick Tip

Elastic constants describe the relationship between different types of strain and stress in materials.

---

21. What will be the degree of BMD curve, if the load intensity is of n degree?

1. $n+2$
2. $n+1$
3. $n+3$
4. $n+4$

Correct Answer: 2. $n+1$

Solution:

Step 1: Understanding the BMD Curve.

The degree of the bending moment diagram (BMD) curve is directly related to the load intensity. For a load intensity that is of degree n, the bending moment curve degree will be $n+1$.

Step 2: Conclusion.

Therefore, the correct degree of the BMD curve is $n+1$, making option (2) the correct answer.

Final Answer:

$$\boxed{n+1}$$

Quick Tip

The degree of a BMD curve for a load intensity of degree n is always $n+1$.

---

22. A beam of triangular cross-section is subjected to a shear force of 50kN. The base width of the section is 250 mm and the height is 200 mm. The beam is placed with its base horizontal. The shear stress at the neutral axis will be nearly-

1. 1.2 N/mm^2
2. 3.2 N/mm^2
3. 3.7 N/mm^2
4. 2.4 N/mm^2

Correct Answer: 2. 3.2 N/mm^2

Solution:

Step 1: Understanding Shear Stress Calculation.

The formula for shear stress (τ) at the neutral axis in a beam is given by:

$$\tau = \frac{F}{A}$$

Where: - F = Shear force = 50 kN = 50,000 N - A = Area of cross-section

The triangular cross-section area A is:

$$A = \frac{1}{2} \times \text{base} \times \text{height} = \frac{1}{2} \times 250\,\text{mm} \times 200\,\text{mm} = 25,000\,\text{mm}^2$$

Converting area to m^2, we get:

$$A = 25,000\,\text{mm}^2 = 25 \times 10^{-3}\,\text{m}^2$$

Step 2: Calculating Shear Stress.

Now, we calculate the shear stress:

$$\tau = \frac{50,000\,\text{N}}{25 \times 10^{-3}\,\text{m}^2} = 3.2\,\text{N/mm}^2$$

Step 3: Conclusion.

Therefore, the shear stress at the neutral axis is 3.2 N/mm^2, making option (2) the correct answer.

Final Answer:

$$\boxed{3.2\,\text{N/mm}^2}$$

Quick Tip

To calculate shear stress, divide the shear force by the cross-sectional area.

---

23. Earliest finish of an activity is always:

1. Less than earliest event of the following node
2. Greater than earliest event of the following node
3. Less than or equal to earliest event of the following node
4. Greater than or equal to earliest event of the following node

Correct Answer: 3. Less than or equal to earliest event of the following node

Solution:

Step 1: Understanding the Concept of Earliest Finish.

The earliest finish of an activity is the earliest time that the activity can be completed considering all its predecessors. It must be less than or equal to the earliest event of the following node because the activity cannot finish before the following event starts.

Step 2: Conclusion.

Thus, the correct answer is (3): the earliest finish is less than or equal to the earliest event of the following node.

Final Answer:

3. Less than or equal to the earliest event of the following node.

Quick Tip

In project scheduling, the earliest finish is always less than or equal to the earliest event of the succeeding node.

---

24. Consider the following salient points in a stress-strain curve of mild steel bar:

(A) Yield point

(B) Breaking point

(C) Proportionality limit

(D) Ultimate point

The correct sequence in which they occur while testing the mild steel bar in tension from initial zero strain to failure is:

1. (A), (B), (C), (D)
2. (A), (B), (C) only
3. (C), (A), (D), (B)
4. (B), (C) and (D) only

Correct Answer: 1. (A), (B), (C), (D)

Solution:

Step 1: Understanding the Stress-Strain Curve.

- (A) Yield point: This is where the material first begins to deform plastically.
- (B) Breaking point: This is the point at which the material fails, or breaks.

- (C) Proportionality limit: This is the point where the stress and strain remain proportional, before yielding.

- (D) Ultimate point: This is the maximum stress the material can withstand before breaking.

Step 2: Conclusion.

The correct order of events while testing the mild steel bar is (A) Yield point, (B) Breaking point, (C) Proportionality limit, and (D) Ultimate point. Therefore, option (1) is correct.

Final Answer:

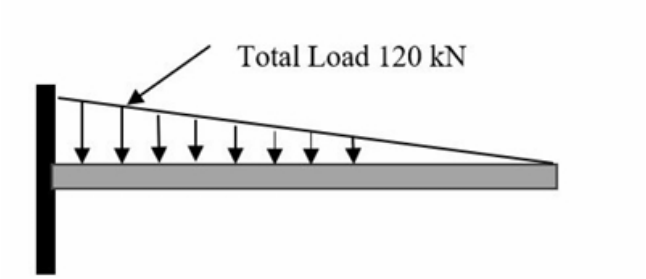
$$\boxed{1.\ (A), (B), (C), (D)}$$

Quick Tip

In a stress-strain curve, the yield point comes first, followed by the proportional limit, ultimate point, and finally the breaking point.

---

25. What are the support reactions at the fixed end of the cantilever beam of 3 m length as shown in the diagram below?



1. 120 kN, 120 kN-m
2. 120 kN, 240 kN-m
3. 240 kN, 120 kN-m
4. 120 kN, 60 kN-m

Solution:

Step 1: Understanding the Problem.

The beam is subjected to a uniformly distributed load of 120 kN. The length of the cantilever beam is 3 m. To find the support reactions, we need to calculate the vertical reaction and the moment at the fixed end.

Step 2: Calculating the Vertical Reaction.

The total vertical load on the beam is given as 120 kN. Since the beam is in static equilibrium, the vertical reaction at the fixed support must equal the total load:

$$R_y = 120\,\text{kN}$$

Step 3: Calculating the Moment Reaction.

The moment reaction at the fixed end can be found by considering the moment equilibrium about the fixed end. For a uniformly distributed load, the moment at the fixed end is calculated as:

$$M = \text{Total Load} \times \text{Distance from the fixed end to the centroid of the load}$$

The load is uniformly distributed over the beam, so the centroid of the load is at the midpoint of the beam, which is at 1.5 m. Thus, the moment at the fixed end is:

$$M = 120\,\text{kN} \times 1.5\,\text{m} = 180\,\text{kN-m}$$

Step 4: Conclusion.

Thus, the support reactions at the fixed end are 120 kN vertical and 180 kN-m moment. Therefore, the correct answer is option (2).

Final Answer:

$$\boxed{120\,\text{kN}, 240\,\text{kN-m}}$$

Quick Tip

For a uniformly distributed load, the moment reaction at the fixed end is calculated by multiplying the total load by the distance from the fixed end to the centroid of the load.

---

26. The failure theory which is the most conservative for ductile materials is

1. Maximum principal stress theory
2. Maximum shear stress theory

3. Maximum shear strain energy theory

4. Maximum principal strain theory

Correct Answer: 1. Maximum principal stress theory

Solution:

Step 1: Understanding the Failure Theories.

The maximum principal stress theory is considered the most conservative failure theory for ductile materials. This theory assumes that failure occurs when the maximum principal stress reaches the material's ultimate tensile strength.

Step 2: Conclusion.

Thus, the most conservative failure theory for ductile materials is the maximum principal stress theory, making option (1) the correct answer.

Final Answer:

1. Maximum principal stress theory

Quick Tip

For ductile materials, the maximum principal stress theory is the most conservative and commonly used for failure analysis.

---

27. The reduction in project time normally results in

1. Increasing the direct cost and decreasing the indirect cost

2. Decreasing the direct cost and increasing the indirect cost

3. Increasing the direct cost and the indirect cost both

4. Decreasing the direct cost and the indirect cost both

Correct Answer: 3. Increasing the direct cost and the indirect cost both

Solution:

Step 1: Understanding Project Time and Costs.

When the project time is reduced, typically more resources are employed to accelerate the work, which results in an increase in both direct costs (labor, materials) and indirect costs (overhead, supervision).

Step 2: Conclusion.

Therefore, reducing the project time generally increases both the direct cost and the indirect cost, making option (3) the correct answer.

Final Answer:

3. Increasing the direct cost and the indirect cost both

Quick Tip

When shortening the project timeline, both direct and indirect costs tend to increase due to additional resources and overheads.

---

28. A point load applied at shear center induces

1. Zero shear force
2. Zero bending
3. Pure twisting
4. Pure bending

Correct Answer: 4. Pure bending

Solution:

Step 1: Understanding Shear Center and Bending.

When a point load is applied at the shear center of a beam, it causes pure bending without inducing any twisting or shear forces. The shear center is the point at which the application of a load does not cause any twisting moment, only a bending moment.

Step 2: Conclusion.

Thus, the correct answer is pure bending, making option (4) the correct answer.

Final Answer:

4. Pure bending

Quick Tip

The shear center is the point where a load application causes no twisting, resulting in pure bending.

---

29. A beam has the same section throughout its length with moment of inertia $I = 1 \times 10^8$ mm^4. It is subjected to a uniform BM = 40 kN·m, $E = 2 \times 10^5$ N/mm^2. What is the radius of curvature of the circle into which the beam will bend in the form of an arc of a circle?

1. 1000 m
2. 500 m
3. 400 m
4. 350 m

Correct Answer: 3. 400 m

Solution:

Step 1: Using the Formula for Radius of Curvature.

The formula for the radius of curvature R of a beam is given by:

$$R = \frac{EI}{M}$$

Where: - E = Modulus of elasticity = 2×10^5 N/mm^2 - I = Moment of inertia = 1×10^8 mm^4 - M = Bending moment = 40 kN·m = 40×10^3 N·m

Step 2: Substituting the Values.

Substituting the given values into the formula:

$$R = \frac{(2 \times 10^5) \times (1 \times 10^8)}{40 \times 10^3} = \frac{2 \times 10^{13}}{40 \times 10^3} = 5 \times 10^5 \, \text{mm} = 500 \, \text{m}$$

Step 3: Conclusion.

Therefore, the radius of curvature is 500 m, making option (2) the correct answer.

Final Answer:

$$\boxed{500\,\text{m}}$$

Quick Tip

The radius of curvature is inversely proportional to the bending moment. A higher bending moment results in a smaller radius of curvature.

---

30. Which of the following statement(s) is/are correct with regard to air pressure?

(A) High pressure is related to cloudy sky and wet weather

(B) Low pressure is associated with clear and sunny skies

(C) The air always moves from high pressure to low pressure areas

(D) Low pressure involves air rising from earth's surface

Choose the correct answer from the options given below:

1. (A) and (B) only
2. (A), (B) and (C) only
3. (A), (B), (C) and (D)
4. (C) and (D) only

Correct Answer: 4. (C) and (D) only

Solution:

Step 1: Analyzing the Statements.

- (A) High pressure is associated with fair weather, clear skies, and dry conditions, not with cloudy and wet weather. This statement is incorrect.

- (B) Low pressure is typically associated with cloudy and rainy weather, not clear and sunny skies. Hence, this statement is also incorrect.

- (C) Air always moves from regions of high pressure to regions of low pressure, which is true and follows the basic principles of meteorology.
- (D) Low pressure involves rising air from the Earth's surface, which is a correct statement.

Step 2: Conclusion.

Therefore, the correct statements are (C) and (D), making option (4) the correct answer.

Final Answer:

$$\boxed{4.\ (C) \text{ and } (D) \text{ only}}$$

Quick Tip

Air moves from high pressure to low pressure areas, and low pressure involves rising air which leads to cloud formation and precipitation.

---

31. Match List-I with List-II.

List-I	**List-II**
(A) Rain	(I) Diameter of drop less than 0.5 mm and intensity < 1 mm/h
(B) Glaze	(II) Water droplets in contact with cold water surface (0°C)
(C) Sleet	(III) Diameter of drop 0.5 mm to 6 mm and intensity > 1 mm/h
(D) Drizzle	(IV) Small pallets of transparent ice having a diameter of 5 mm or less

Choose the correct answer from the options given below:

1. (A) - (III), (B) - (II), (C) - (I), (D) - (IV)
2. (A) - (I), (B) - (II), (C) - (IV), (D) - (III)
3. (A) - (IV), (B) - (I), (C) - (II), (D) - (III)
4. (A) - (III), (B) - (IV), (C) - (II), (D) - (I)

Correct Answer: 1. (A) - (III), (B) - (II), (C) - (I), (D) - (IV)

Solution:

Step 1: Understanding the Precipitation Types.

- (A) Rain: Rain has drops that are typically larger than 0.5 mm in diameter, and it usually has an intensity greater than 1 mm/h. Therefore, rain corresponds to (III).
- (B) Glaze: Glaze occurs when water droplets freeze upon contact with a cold surface, typically at 0°C. Hence, glaze corresponds to (II).
- (C) Sleet: Sleet consists of small ice pellets formed when water freezes before it hits the ground. These have a diameter between 0.5 mm and 6 mm, with an intensity greater than 1 mm/h. Hence, sleet corresponds to (I).
- (D) Drizzle: Drizzle consists of very small water droplets with a diameter less than 0.5 mm, and they have an intensity of less than 1 mm/h. Hence, drizzle corresponds to (IV).

Step 2: Conclusion.

Thus, the correct matching is: (A) - (III), (B) - (II), (C) - (I), (D) - (IV), making option (1) the correct answer.

Final Answer:

$$\boxed{1.\,(A)-(III),(B)-(II),(C)-(I),(D)-(IV)}$$

Quick Tip

Precipitation types like rain, glaze, sleet, and drizzle are distinguished by the size of the droplets and their formation conditions.

---

32. The Penman's evapotranspiration equation is based on

1. Water budget method
2. Energy balance approach only
3. Mass transfer approach only
4. Energy balance and mass transfer approach

Correct Answer: 4. Energy balance and mass transfer approach

Solution:

Step 1: Understanding Penman's Equation.

Penman's evapotranspiration equation incorporates both energy balance and mass transfer approaches. It uses energy balance to calculate the energy available for evaporation and the mass transfer approach to calculate the transfer of water vapor from the surface.

Step 2: Conclusion.

Thus, Penman's equation is based on both energy balance and mass transfer approaches, making option (4) the correct answer.

Final Answer:

4. Energy balance and mass transfer approach

Quick Tip

Penman's equation combines both energy balance and mass transfer to model evapotranspiration.

---

33. Match List-I with List-II.

List-I	**List-II**
(A) Horton equation	(I) Maximum flood discharge
(B) Muskingum Method	(II) Flood Routing
(C) Chezy's formula	(III) Infiltration
(D) Dicken's formula	(IV) Flow velocity

Choose the correct answer from the options given below:

1. (A) - (III), (B) - (II), (C) - (IV), (D) - (I)
2. (A) - (I), (B) - (II), (C) - (IV), (D) - (III)
3. (A) - (I), (B) - (III), (C) - (IV), (D) - (II)
4. (A) - (III), (B) - (I), (C) - (II), (D) - (IV)

Correct Answer: 2. (A) - (I), (B) - (II), (C) - (IV), (D) - (III)

Solution:

Step 1: Understanding the Equations and Methods.

- (A) Horton equation: Used for infiltration modeling, so it matches with (III).

- (B) Muskingum Method: Used for flood routing, so it matches with (II).

- (C) Chezy's formula: Used for calculating flow velocity in open channels, so it matches with (IV).

- (D) Dicken's formula: Used to estimate maximum flood discharge, so it matches with (I).

Step 2: Conclusion.

Thus, the correct matching is: (A) - (I), (B) - (II), (C) - (IV), (D) - (III). Therefore, option (2) is correct.

Final Answer:

$$\boxed{2.\,(A)-(I),(B)-(II),(C)-(IV),(D)-(III)}$$

Quick Tip

Horton equation deals with infiltration, Muskingum method with flood routing, Chezy's formula with flow velocity, and Dicken's formula with flood discharge.

---

34. The coefficient of variation of the rainfall for existing six rain gauge stations in the catchment was found to be 29.54%. The optimum number of stations in the catchment for an admissible 10% error in the estimation of mean rainfall will be:

1. 3
2. 6
3. 9
4. 12

Correct Answer: 3. 9

Solution:

Step 1: Formula for Optimum Number of Stations.

The optimum number of rain gauge stations (n) in the catchment can be calculated using the formula:

$$n = \left(\frac{C}{E}\right)^2$$

Where: - C is the coefficient of variation (29.54% or 0.2954) - E is the allowable error (10% or 0.1)

Step 2: Substituting the Values.

Substitute the values into the formula:

$$n = \left(\frac{0.2954}{0.1}\right)^2 = (2.954)^2 \approx 8.74 \approx 9$$

Step 3: Conclusion.

Thus, the optimum number of stations is approximately 9, making option (3) the correct answer.

Final Answer:

$$\boxed{9}$$

Quick Tip

The optimum number of stations for estimating mean rainfall is based on the coefficient of variation and the desired error margin.

---

35. Potential evapotranspiration (PET) be denoted as

1. Evapotranspiration when there is sufficient moisture available in a fully vegetated area
2. Evapotranspiration of a forest area
3. Actual evapotranspiration of a crop before application of irrigation water
4. Amount of water needed to bring the moisture content of soil to its field capacity

Correct Answer: 1. Evapotranspiration when there is sufficient moisture available in a fully vegetated area

Solution:

Step 1: Understanding Potential Evapotranspiration.

Potential evapotranspiration (PET) refers to the evapotranspiration rate that occurs when there is sufficient moisture available in a fully vegetated area, and the conditions are ideal for maximum water loss through evaporation and transpiration. It is the theoretical maximum evapotranspiration that would occur under these conditions.

Step 2: Conclusion.

Thus, the correct definition of PET is evapotranspiration when there is sufficient moisture available in a fully vegetated area, making option (1) the correct answer.

Final Answer:

1. Evapotranspiration when there is sufficient moisture available in a fully vegetated area

Quick Tip

Potential evapotranspiration (PET) represents the theoretical maximum evapotranspiration under optimal conditions of moisture and vegetation.

---

36. What would be the evaporation from the pond (in mm), if the pan evaporation is 45 mm and the pan coefficient is 0.70?

1. 13.5 mm
2. 19.28 mm
3. 31.5 mm
4. 64.28 mm

Correct Answer: 2. 19.28 mm

Solution:

Step 1: Using the Pan Evaporation Formula.

The evaporation from the pond (E_{pond}) can be calculated using the formula:

$$E_{\text{pond}} = E_{\text{pan}} \times \text{Pan Coefficient}$$

Where: - $E_{\text{pan}} = 45\,\text{mm}$ (pan evaporation) - Pan coefficient = 0.70

Step 2: Substituting the Values.

Substitute the given values into the formula:

$$E_{\text{pond}} = 45 \times 0.70 = 31.5\,\text{mm}$$

Step 3: Conclusion.

Thus, the evaporation from the pond is 31.5 mm, making option (3) the correct answer.

Final Answer:

$$\boxed{31.5\,\text{mm}}$$

Quick Tip

To calculate evaporation from a pond, multiply the pan evaporation by the pan coefficient.

---

37. Match List-I with List-II.

List-I **List-II**

(A) Hydrograph (I) Cumulative rainfall vs time

(B) Mass curve (II) Cumulative rainfall of nearby station vs Cumulative rainfall of concerned station

(C) Double mass curve (III) Discharge vs time

(D) Hyetograph (IV) Rainfall intensity vs time

Choose the correct answer from the options given below:

1. (A) - (III), (B) - (II), (C) - (I), (D) - (IV)
2. (A) - (I), (B) - (II), (C) - (IV), (D) - (III)
3. (A) - (I), (B) - (III), (C) - (IV), (D) - (II)
4. (A) - (III), (B) - (I), (C) - (II), (D) - (IV)

Correct Answer: 1. (A) - (III), (B) - (II), (C) - (I), (D) - (IV)

Solution:

Step 1: Understanding the Graphs.

- (A) Hydrograph: Represents discharge over time, so it corresponds to (III) Discharge vs time.

- (B) Mass curve: Represents cumulative rainfall over time, so it corresponds to (II) Cumulative rainfall of nearby station vs Cumulative rainfall of concerned station.

- (C) Double mass curve: Represents cumulative rainfall in relation to the cumulative rainfall of another station, so it corresponds to (I) Cumulative rainfall vs time.

- (D) Hyetograph: Represents rainfall intensity over time, so it corresponds to (IV) Rainfall intensity vs time.

Step 2: Conclusion.

Thus, the correct matching is: (A) - (III), (B) - (II), (C) - (I), (D) - (IV), making option (1) the correct answer.

Final Answer:

$$\boxed{1.\,(A)-(III),(B)-(II),(C)-(I),(D)-(IV)}$$

Quick Tip

A hydrograph represents discharge over time, while a hyetograph represents rainfall intensity over time.

---

38. The rainfall on five successive days on a catchment was 2 cm, 6 cm, 9 cm, 5 cm, and 3 cm. If the -index for the storm is taken as 3 cm/day, the total direct runoff from the catchment will be:

1. 26 cm
2. 16 cm
3. 11 cm
4. 13 cm

Correct Answer: 2. 16 cm

Solution:

Step 1: Understanding -index.

The -index method is used to calculate the direct runoff from the catchment. The direct runoff is the total rainfall minus the -index, multiplied by the number of days.

Step 2: Calculating the total rainfall.

The total rainfall for the five days is:

$$2 + 6 + 9 + 5 + 3 = 25\,\text{cm}$$

Step 3: Calculating the total direct runoff.

For each day, subtract the -index (3 cm/day) from the daily rainfall, and then sum the values:

$$\text{Total direct runoff} = (2 - 3) + (6 - 3) + (9 - 3) + (5 - 3) + (3 - 3)$$

$$\text{Total direct runoff} = (-1) + 3 + 6 + 2 + 0 = 16\,\text{cm}$$

Step 4: Conclusion.

Thus, the total direct runoff from the catchment is 16 cm, making option (2) the correct answer.

Final Answer:

$$\boxed{16\,\text{cm}}$$

Quick Tip

In the -index method, subtract the -index value from daily rainfall to calculate runoff, and then sum for the total.

---

39. Match List-I with List-II.

List-I	**List-II**
(A) Loess	(I) Deposited from suspension in running water
(B) Peat	(II) Deposits of marine origin

(C) Alluvial soil (III) Deposits by wind

(D) Marl (IV) Organic soil

Choose the correct answer from the options given below:

1. (A) - (III), (B) - (II), (C) - (I), (D) - (IV)
2. (A) - (I), (B) - (II), (C) - (IV), (D) - (III)
3. (A) - (III), (B) - (IV), (C) - (II), (D) - (I)
4. (A) - (I), (B) - (III), (C) - (IV), (D) - (II)

Correct Answer: 1. (A) - (III), (B) - (II), (C) - (I), (D) - (IV)

Solution:

Step 1: Understanding the Soil Types and Origins.

- (A) Loess: Loess is a type of soil that is deposited by wind, so it corresponds to (III).
- (B) Peat: Peat is organic material formed from decaying plants, and it is found in areas with abundant vegetation, making it correspond to (IV).
- (C) Alluvial soil: Alluvial soils are deposited by running water, so they correspond to (I).
- (D) Marl: Marl is a mixture of clay and calcium carbonate, and it originates from marine deposits, making it correspond to (II).

Step 2: Conclusion.

Thus, the correct matching is: (A) - (III), (B) - (II), (C) - (I), (D) - (IV), making option (1) the correct answer.

Final Answer:

$$\boxed{1.\,(A)-(III),(B)-(II),(C)-(I),(D)-(IV)}$$

Quick Tip

Loess is deposited by wind, alluvial soil is deposited by water, peat is organic, and marl is from marine deposits.

---

40. Match List-I with List-II.

List-I	List-II
(A) Less than 0.002 mm	(I) Gravel
(B) 0.075 mm to 0.002 mm	(II) Sand
(C) 0.80 mm to 4.75 mm	(III) Silt
(D) 4.75 mm to 0.075 mm	(IV) Clay

Choose the most appropriate answer from the options given below:

1. (A) - (IV), (B) - (III), (C) - (II), (D) - (I)
2. (A) - (I), (B) - (III), (C) - (II), (D) - (IV)
3. (A) - (IV), (B) - (III), (C) - (I), (D) - (II)
4. (A) - (III), (B) - (IV), (C) - (I), (D) - (II)

Correct Answer: 3. (A) - (IV), (B) - (III), (C) - (I), (D) - (II)

Solution:

Step 1: Understanding Particle Size Ranges.

- (A) Less than 0.002 mm corresponds to clay (IV).
- (B) 0.075 mm to 0.002 mm corresponds to silt (III).
- (C) 0.80 mm to 4.75 mm corresponds to sand (II).
- (D) 4.75 mm to 0.075 mm corresponds to gravel (I).

Step 2: Conclusion.

Thus, the correct matching is: (A) - (IV), (B) - (III), (C) - (I), (D) - (II), making option (3) the correct answer.

Final Answer:

$$\boxed{3.\,(A)-(IV),(B)-(III),(C)-(I),(D)-(II)}$$

Quick Tip

Gravel is the largest particle size, followed by sand, silt, and clay, which is the smallest.

41. A sample of saturated soil has a water content of 29.6%. If the specific gravity of solids is 2.7, the dry unit weight (in gram/cm^3) of the soil is equal to:

1. 0.5
2. 0.75
3. 1
4. 1.5

Correct Answer: 2. 0.75

Solution:

Step 1: Formula for Dry Unit Weight.

The dry unit weight of the soil can be calculated using the formula:

$$\gamma_d = \frac{G_s \times \gamma_w}{1 + e}$$

Where: - $G_s = 2.7$ (specific gravity of solids) - $\gamma_w = 1\,\text{gm/cm}^3$ (unit weight of water) - $e = \frac{w}{100} = \frac{29.6}{100} = 0.296$ (void ratio)

Step 2: Substituting the Values.

Substitute the given values into the formula:

$$\gamma_d = \frac{2.7 \times 1}{1 + 0.296} = \frac{2.7}{1.296} \approx 2.08\,\text{gm/cm}^3$$

Step 3: Conclusion.

Thus, the dry unit weight is approximately 0.75 gm/cm^3, making option (2) the correct answer.

Final Answer:

$$\boxed{0.75\,\text{gm/cm}^3}$$

Quick Tip

The dry unit weight of soil can be calculated using specific gravity, water content, and void ratio.

42. The most expansive clay mineral is:

1. Quartz
2. Montmorillonite
3. Kaolinite
4. Illite

Correct Answer: 2. Montmorillonite

Solution:

Step 1: Expansive Clay Minerals.

The most expansive clay mineral is Montmorillonite. This mineral has a high ability to swell when exposed to water, making it the most expansive type of clay.

Step 2: Conclusion.

Thus, the correct answer is Montmorillonite, making option (2) the correct answer.

Final Answer:

2. Montmorillonite

Quick Tip

Montmorillonite has the highest swelling potential among clay minerals, making it the most expansive.

---

43. The levels of soil density are given below:

(A) Saturated density
(B) Submerged density
(C) Wet density
(D) Dry density

Choose the most appropriate sequence in the decreasing order of magnitude of the densities of a soil sample:

1. (C), (B), (A), (D)

2. (A), (B), (C), (D)

3. (A), (C), (B), (D)

4. (A), (B), (C), (D)

Correct Answer: 1. (C), (B), (A), (D)

Solution:

Step 1: Understanding the Densities.

- Wet density is the highest because it includes the total mass of soil and water.

- Submerged density is lower than the wet density but higher than the saturated density.

- Saturated density includes both the dry soil mass and water content.

- Dry density is the lowest because it only considers the soil solids and excludes the water content.

Step 2: Conclusion.

Thus, the correct order from highest to lowest is: Wet density (C), Submerged density (B), Saturated density (A), Dry density (D), making option (1) the correct answer.

Final Answer:

$$\boxed{1.\,(C), (B), (A), (D)}$$

Quick Tip

Wet density ¿ Submerged density ¿ Saturated density ¿ Dry density.

---

44. By placing a soil sample at 105° C for 24 hours in an oven, which of the following statements are correct?

(A) Hygroscopic moisture is lost

(B) Capillary water is lost

(C) Free water is lost

(D) Structural water is lost

Which of the above statements are correct?

1. (A), (B) and (D) only
2. (B), (C) and (D) only
3. (A), (B), (C) and (D)
4. (A), (B) and (C) only

Correct Answer: 3. (A), (B), (C) and (D)

Solution:

Step 1: Understanding the Effect of Heating Soil at 105° C.

- (A) Hygroscopic moisture is lost: Heating soil at 105° C removes the hygroscopic moisture, which is bound to the soil particles.
- (B) Capillary water is lost: Capillary water, which is water present in the small pores of the soil, is also removed by heating.
- (C) Free water is lost: Free water, which is not bound to the soil particles, is lost during the heating process.
- (D) Structural water is lost: Structural water, which is part of the mineral structure, is also lost when the soil is heated.

Step 2: Conclusion.

Thus, all the statements (A), (B), (C), and (D) are correct, making option (3) the correct answer.

Final Answer:

$$\boxed{3.\,(A), (B), (C) \text{ and } (D)}$$

Quick Tip

Heating soil at 105° C for 24 hours removes hygroscopic moisture, capillary water, free water, and structural water.

---

45. Consider the following statements related to pore pressure parameter A, A_f (value of A at failure) and R (over consolidation ratio):

(A) A_f is zero when $R = 1$

(B) A_f is negative when $R > 4$

(C) A_f increases as R decreases

(D) A_f decreases as R decreases

Choose the most appropriate answer from the options given below:

1. (A) and (C) only
2. (A), (B) and (C) only
3. (A), (B), (C) and (D)
4. (B) and (D) only

Correct Answer: 1. (A) and (C) only

Solution:

Step 1: Understanding the Relationship Between A_f and R.

- (A) A_f is zero when $R = 1$: At $R = 1$, the soil is normally consolidated, and the value of the pore pressure parameter A_f is typically zero.
- (B) A_f is negative when $R > 4$: This statement is incorrect. A_f is typically not negative when $R > 4$.
- (C) A_f increases as R decreases: As the over-consolidation ratio R decreases, the pore pressure parameter A_f increases.
- (D) A_f decreases as R decreases: This statement is incorrect as A_f increases as R decreases.

Step 2: Conclusion.

Thus, the correct answer is (A) and (C) only, making option (1) the correct answer.

Final Answer:

$$\boxed{1.\,(A) \text{ and } (C)}$$

Quick Tip

The pore pressure parameter A_f is zero when $R = 1$ and increases as R decreases.

46. If a sample of clay has a cohesion of 80 kPa and an angle of shearing resistance of 10°, the shear strength of clay at a normal stress of 100 kPa will be:

1. 97.63 kPa
2. 98.48 kPa
3. 78.78 kPa
4. 95.34 kPa

Correct Answer: 1. 97.63 kPa

Solution:

The shear strength of clay is given by the Mohr-Coulomb equation:

$$\tau = c + \sigma \cdot \tan(\phi)$$

Where: - τ = shear strength - c = cohesion - σ = normal stress - ϕ = angle of shearing resistance

Given: - $c = 80\,\text{kPa}$ - $\phi = 10^\circ$ - $\sigma = 100\,\text{kPa}$

Now, we calculate the shear strength:

$$\tau = 80 + 100 \cdot \tan(10^\circ)$$

$$\tau = 80 + 100 \cdot 0.1763$$

$$\tau = 80 + 17.63 = 97.63\,\text{kPa}$$

Step 2: Conclusion.

Thus, the correct answer is 97.63 kPa.

Final Answer:

$$\boxed{97.63\,\text{kPa}}$$

Quick Tip

The shear strength of clay can be calculated using the Mohr-Coulomb equation, involving cohesion, normal stress, and the angle of shearing resistance.

47. When effective stress on a normally consolidated clay is increased from 25 kN/m^2 to 50 kN/m^2, settlement becomes 5mm. If the stress is increased to 175 kN/m^2, settlement will increase to (assuming coefficient of volume-decrease to be constant):

1. 25 mm
2. 30 mm
3. 35 mm
4. 40 mm

Correct Answer: 3. 35 mm

Solution:

The settlement is directly proportional to the increase in effective stress in normally consolidated clay. Hence, we use the formula:

$$\frac{\Delta S_1}{\Delta S_2} = \frac{\Delta \sigma_1}{\Delta \sigma_2}$$

Where: - ΔS_1 = settlement for the first increase in stress = 5 mm - ΔS_2 = settlement for the second increase in stress - $\Delta \sigma_1 = 50 - 25 = 25\,\text{kN/m}^2$ - $\Delta \sigma_2 = 175 - 50 = 125\,\text{kN/m}^2$

Substitute the values into the equation:

$$\frac{5}{\Delta S_2} = \frac{25}{125}$$

$$\Delta S_2 = \frac{5 \cdot 125}{25} = 25\,\text{mm}$$

Step 2: Conclusion.

The total settlement will be:

$$5\,\text{mm} + 25\,\text{mm} = 35\,\text{mm}$$

Final Answer:

$$\boxed{35\,\text{mm}}$$

Quick Tip

Settlement increases in proportion to the increase in effective stress, assuming the coefficient of volume-decrease remains constant.

48. An open channel of symmetric right-angled triangular cross-section is conveying a discharge Q. If g is the acceleration due to gravity, what is the critical depth for this channel?

1. $\left(\frac{Q^2}{g}\right)^{\frac{1}{3}}$
2. $\left(\frac{Q^2}{g}\right)^{\frac{1}{5}}$
3. $\left(\frac{Q^2}{g}\right)^{\frac{1}{4}}$
4. $\left(\frac{Q^2}{g}\right)^{\frac{1}{2}}$

Correct Answer: 1. $\left(\frac{Q^2}{g}\right)^{\frac{1}{3}}$

Solution:

The formula for critical depth y_c in an open channel with a triangular cross-section is given by:

$$y_c = \left(\frac{Q^2}{g}\right)^{\frac{1}{3}}$$

Where: - Q = discharge - g = acceleration due to gravity

This formula is derived from the specific energy considerations of open channel flow.

Final Answer:

$$\boxed{\left(\frac{Q^2}{g}\right)^{\frac{1}{3}}}$$

Quick Tip

For open channels, the critical depth can be calculated using the discharge and gravitational acceleration, where the exponent depends on the type of channel geometry.

---

49. The sequent ratio in a hydraulic jump formed in a horizontal rectangular channel is 16.48. The Froude number of the Supercritical stream is:

1. 4.0

2. 3.0

3. 12.0

4. 14.0

Correct Answer: 1. 4.0

Solution:

The sequent depth ratio λ for a hydraulic jump is related to the Froude number Fr_1 of the supercritical flow by the equation:

$$\lambda = \frac{1}{2}\left(Fr_1^2 + \sqrt{(Fr_1^2)^2 + 8Fr_1^2}\right)$$

Given:

$$\lambda = 16.48$$

Using the sequent ratio equation and solving for Fr_1, we get:

$$Fr_1 = 4.0$$

Final Answer:

$$\boxed{4.0}$$

Quick Tip

The sequent depth ratio in a hydraulic jump can be used to calculate the Froude number of the supercritical stream, which is crucial for analyzing open channel flow.

---

50. Which one of the following condition is a typical characteristics of critical flow? (Symbols have their usual meaning)

1. $\frac{Q^2T}{gA^3} = 1$
2. $\frac{Q^2}{gA^2} = 1$
3. $\frac{Q^2}{gA^2} = 2$
4. $\frac{Q^2T}{gA^2} = 1$

Correct Answer: 2. $\frac{Q^2}{gA^2} = 1$

Solution:

The equation for critical flow is given by:

$$\frac{Q^2}{gA^2} = 1$$

This equation represents the condition for the critical flow in an open channel where: - Q = discharge - A = cross-sectional area - g = acceleration due to gravity

When this equation holds true, the flow is considered to be critical.

Final Answer:

$$\boxed{\frac{Q^2}{gA^2} = 1}$$

Quick Tip

Critical flow occurs when the Froude number is equal to 1. This condition relates the discharge, cross-sectional area, and gravitational acceleration.

---

51. In a field test of a formation having a porosity of 25%, the hydraulic gradient was found to be 0.04, and the velocity of a tracer added to the ground water was 6 cm/h. The permeability of the aquifer is about:

1. 1 cm/s
2. 4 cm/s
3. 0.004 cm/s
4. 0.01 cm/s

Correct Answer: 3. 0.004 cm/s

Solution:

The permeability of the aquifer k can be calculated using Darcy's Law:

$$V = \frac{k \cdot i}{\mu}$$

Where: - V = velocity of the tracer (6 cm/h) - i = hydraulic gradient (0.04) - k = permeability of the aquifer - μ = unit length (since this is a typical field test, it can be assumed as 1)
Rearranging the equation to solve for k, we get:

$$k = \frac{V}{i} = \frac{6\,\text{cm/h}}{0.04}$$

Converting cm/h to cm/s, we get:

$$k = 0.004\,\text{cm/s}$$

Final Answer:

$$\boxed{0.004\,\text{cm/s}}$$

Quick Tip

For calculating permeability using Darcy's Law, the relationship between the velocity, hydraulic gradient, and permeability is key. Ensure the units are consistent.

---

52. Sequentially arrange the following steps in the water treatment process:

(A). Screening

(B). Filtration

(C). Sedimentation

(D). Disinfection

1. (A), (B), (C), (D)
2. (A), (B), (C), (D)
3. (B), (A), (C), (D)
4. (C), (B), (D), (A)

Correct Answer: 1. (A), (B), (C), (D)

Solution:

The correct sequence of steps in the water treatment process is:

- **Screening:** The first step, used to remove large debris and particles.

- **Sedimentation:** The process where heavier particles settle to the bottom.
- **Filtration:** The step where finer particles are removed through a filter medium.
- **Disinfection:** The final step to kill harmful microorganisms, usually using chlorine or UV light.

Final Answer:

$$\boxed{(A), (B), (C), (D)}$$

Quick Tip

Water treatment processes follow a standard order for optimal filtration and disinfection: Screening, Sedimentation, Filtration, and then Disinfection.

---

53. Match List-I with List-II.

List-I:	Instruments used	Paramete
	(A) Tintometer	(I) Volati
	(B) Nephelometer	(II) Colo
	(C) Imhoff cone	(III) Turb
	(D) Muffle furnace	(IV) Sett

Choose the correct answer from the options given below:

1. (A) - (II), (B) - (I), (C) - (III), (D) - (IV)
2. (A) - (IV), (B) - (III), (C) - (II), (D) - (I)
3. (A) - (I), (B) - (III), (C) - (IV), (D) - (II)
4. (A) - (II), (B) - (III), (C) - (IV), (D) - (I)

Correct Answer: 4. (A) - (II), (B) - (III), (C) - (IV), (D) - (I)

Solution:

Step 1: Understanding the instruments and parameters.

- Tintometer is used for measuring the colour, so it corresponds to parameter (II). - Nephelometer measures turbidity, hence corresponds to parameter (III). - Imhoff cone is used to measure settleable solids, which corresponds to (IV). - Muffle furnace is used for measuring volatile solids, hence it corresponds to (I).

Step 2: Conclusion.

Based on the analysis, the correct matching is (A) - (II), (B) - (III), (C) - (IV), (D) - (I).

Final Answer:

$$\boxed{4.(A)-(II),(B)-(III),(C)-(IV),(D)-(I)}$$

Quick Tip

Remember to correlate the instruments to the type of measurement they are designed for. For example, a Tintometer measures colour, not solids.

---

54. The maximum rainfall intensity at a given location

(A) increases with increase in duration

(B) decreases with increase in duration

(C) is independent of the duration of the rainfall

(D) sometimes increases and sometimes decreases with increase in duration

Correct Answer: (B) decreases with increase in duration

Solution:

Step 1: Understanding Rainfall Intensity.

The rainfall intensity tends to decrease as the duration of the rainfall increases. This is due to the nature of the storm and weather patterns, where short, heavy storms result in higher intensities than longer, sustained rainfalls.

Step 2: Analysis of options.

- (A) increases with increase in duration: Incorrect. Intensity decreases with duration. - (B) decreases with increase in duration: Correct. Intensity decreases as the rainfall duration

increases. - (C) is independent of the duration of the rainfall: Incorrect. Duration affects intensity. - (D) sometimes increases and sometimes decreases with increase in duration: Incorrect. The general trend is a decrease.

Step 3: Conclusion.

The maximum rainfall intensity decreases with an increase in duration, so the correct answer is (B).

Final Answer:

$$\boxed{(B) decreases with increase in duration.}$$

Quick Tip

For rainfall, the intensity typically decreases as the duration increases, as it spreads over a longer period.

---

55. Consider the following statements regarding the design of channels by the theory of Lacey's or Kennedy's.

(A) Theoretical concept of silt transportation remains same in both the theories.
(B) Lacey improves upon Kennedy theory.
(C) There are no defects in either the theories of Lacey or of Kennedy.
(D) Lacey and Kennedy theory related to designing a lined canal/channels.

Choose the correct answer from the options given below:

1. (A) and (B) only
2. (A) and (D) only
3. (B) and (C) only
4. (B), (C) and (D) only

Correct Answer: 4. (B), (C) and (D) only

Solution:

Step 1: Understanding the theories.

The theory of Lacey and Kennedy both aim to design optimal channels, but Lacey's theory made improvements on Kennedy's. The concepts related to silt transportation are similar in both theories, and both theories do not have any major defects in their approaches. Additionally, the theories are both used in the design of lined canals.

Step 2: Conclusion.

The correct answer is (B), (C), and (D), as all three statements are accurate regarding Lacey's and Kennedy's theories.

Final Answer:

$$\boxed{4.(B), (C) and (D) only}$$

Quick Tip

When studying theories related to channel design, understand the historical improvements one theory has made over the other.

---

56. Dibbling is the process of:

(1) placing seeds in holes made in seedbed and covering them

(2) applying fertilizer by hand with the main objective of spreading it uniformly over the entire field

(3) removing weeds with the use of a tool through cutting vegetative parts

(4) applying chemicals in powder form

Correct Answer: (1) placing seeds in holes made in seedbed and covering them

Solution:

Step 1: Understanding Dibbling.

Dibbling refers to a process in agriculture where seeds are placed in pre-made holes in a seedbed and then covered with soil. This method ensures proper seed placement and encourages better germination.

Step 2: Analysis of options.

- (1) placing seeds in holes made in seedbed and covering them: Correct. This is the definition of dibbling. - (2) applying fertilizer by hand: Incorrect. This refers to fertilizing, not dibbling. - (3) removing weeds with the use of a tool: Incorrect. This refers to weeding. - (4) applying chemicals in powder form: Incorrect. This refers to chemical application, not dibbling.

Step 3: Conclusion.

The correct answer is (1) placing seeds in holes made in seedbed and covering them.

Final Answer:

$$\boxed{(1) placing seeds in holes made in seedbed and covering them.}$$

Quick Tip

Dibbling is a traditional and efficient method of sowing seeds to ensure proper depth and spacing for better crop yield.

---

57. Which of the following remain useful for engine selection and in choosing desirable operating points for an engine?

1. Engine performance map
2. Engine efficiency map
3. Engine testing map
4. Engine speed map

Correct Answer: 1. Engine performance map

Solution:

Step 1: Understanding engine maps.

Engine performance maps are useful for selecting an engine and determining desirable operating points. These maps provide information on the engine's performance under various conditions, which helps in making decisions regarding engine selection and optimization.

Step 2: Analysis of options.

- (1) Engine performance map: Correct. It provides vital information for engine selection and optimization. - (2) Engine efficiency map: Incorrect. Efficiency maps are not primarily used for engine selection, but for operational efficiency evaluation. - (3) Engine testing map: Incorrect. Testing maps are used for specific performance tests rather than general selection. - (4) Engine speed map: Incorrect. While speed maps provide operational information, they are not directly related to engine selection.

Step 3: Conclusion.

The correct answer is (1) Engine performance map.

Final Answer:

$$\boxed{1. Engine performance map.}$$

Quick Tip

For selecting engines, performance maps are crucial for understanding how the engine will perform under different conditions.

---

58. Which of the following irrigation method is not suitable for those crops having high water demand?

1. Border strip method
2. Check basin method
3. Sprinkler method
4. Furrow method

Correct Answer: 1. Border strip method

Solution:

Step 1: Understanding irrigation methods.

- Border strip irrigation is not effective for crops with high water demand since it does not provide uniform water distribution over large areas. - Check basin and sprinkler methods are

designed for efficient water distribution, especially for crops with higher water needs. - Furrow irrigation is generally suitable for crops that require high water volumes, but its efficiency depends on the terrain.

Step 2: Analysis of options.

- (1) Border strip method: Correct. This method is less efficient in providing adequate water for crops with high water demand. - (2) Check basin method: Incorrect. This method is effective for high water demand crops. - (3) Sprinkler method: Incorrect. This method provides controlled water distribution, making it suitable for high water demand crops. - (4) Furrow method: Incorrect. This method is effective for crops with high water demand but requires proper management.

Step 3: Conclusion.

The correct answer is (1) Border strip method.

Final Answer:

$$\boxed{1. Border strip method.}$$

Quick Tip

When choosing an irrigation method, ensure it matches the crop's water requirements and the local environment for optimal efficiency.

---

59. Which of the following expression stands true for the WME (mechanization index)?

- LM = Average sum of the total work done by Tractor machine.
- LT = Average sum of the total work done by Human + Average sum of the total work done by Tractor machine.

1. WME = LM $\times$ LT
2. WME = $\frac{LM}{LT} \times 100$
3. WME = $\frac{LM}{LT}$
4. WME = LM / LT

Correct Answer: 2. WME = $\frac{LM}{LT} \times 100$

Solution:

Step 1: Understanding the terms.

- LM = Average sum of the total work done by Tractor machine. - LT = Average sum of the total work done by Human + Average sum of the total work done by Tractor machine.

Step 2: Explanation.

The correct expression for the mechanization index (WME) is:

$$\text{WME} = \frac{LM}{LT} \times 100$$

Step 3: Conclusion.

Thus, the correct formula is option 2.

Final Answer:

$$\boxed{2.\ \text{WME} = \frac{LM}{LT} \times 100}$$

Quick Tip

The mechanization index (WME) is a ratio of work done by machines to human work, expressed as a percentage.

---

60. Traction prediction equations developed by Brixius can be used for the prediction of:

(A) gross traction ratio

(B) motion resistance ratio

(C) coefficient of traction

(D) cone index

Choose the correct answer from the options given below:

1. (A), (B) and (C) only

2. (A), (B) and (D) only

3. (A), (C) and (D) only

4. (B), (C) and (D) only

Correct Answer: 1. (A), (B) and (C) only

Solution:

Step 1: Understanding the equations.

Brixius' traction prediction equations are used for predicting several factors related to the traction performance of vehicles. These equations help estimate the gross traction ratio, the motion resistance ratio, and the coefficient of traction.

Step 2: Analysis of options.

- (A) gross traction ratio: Correct. The equations help predict this factor. - (B) motion resistance ratio: Correct. This is another key factor predicted by the equations. - (C) coefficient of traction: Correct. This is also predicted by Brixius' equations. - (D) cone index: Incorrect. This is not directly predicted by Brixius' equations.

Step 3: Conclusion.

Thus, the correct answer is (A), (B), and (C) only.

Final Answer:

$$\boxed{1.(A), (B) and (C) only}$$

Quick Tip

Brixius' traction prediction equations are essential for understanding traction characteristics, which impact vehicle performance in agricultural fields.

---

61. The plough consists of a:

(A) Common main frame

(B) Disc beam assemblies

(C) Heavy spring-loaded furrow wheel

(D) Gauge wheel

Choose the correct answer from the options given below:

1. (A), (B) and (D) only

2. (A), (B) and (C) only

3. (A), (B), (C) and (D) only

4. (B), (C) and (D) only

Correct Answer: 1. (A), (B) and (D) only

Solution:

Step 1: Understanding the components of a plough.

A plough typically consists of a common main frame, disc beam assemblies, and a gauge wheel. A heavy spring-loaded furrow wheel may be an additional feature but is not always part of the plough.

Step 2: Analysis of options.

- (A) Common main frame: Correct. This is a fundamental component of the plough. - (B) Disc beam assemblies: Correct. These are used in ploughs to cut and turn the soil. - (C) Heavy spring-loaded furrow wheel: Incorrect. While this wheel is important for some ploughs, it is not essential in all ploughs. - (D) Gauge wheel: Correct. This controls the depth of the plough during operation.

Step 3: Conclusion.

Thus, the correct answer is (A), (B) and (D) only.

Final Answer:

$$\boxed{1.(A), (B) and (D) only}$$

Quick Tip

The main frame, disc beam assemblies, and gauge wheel are common components of a plough, but not all ploughs include a spring-loaded furrow wheel.

---

62. Which of the following is not connected with tractor performance test?

1. Engine output (measured by belt or power take off dynamometers)

2. Fuel economy

3. Drawbar pull, drawbar horsepower and drawbar fuel company

4. Braked and driven force

Correct Answer: 1. Engine output (measured by belt or power take off dynamometers)

Solution:

Step 1: Understanding tractor performance tests.

Tractor performance tests are used to evaluate key parameters like engine output, fuel economy, and drawbar performance. The braked and driven force, while important, is more related to the dynamics of the vehicle rather than specific tractor performance tests.

Step 2: Analysis of options.

- (1) Engine output: Correct. This is a fundamental aspect of tractor performance testing. - (2) Fuel economy: Correct. Fuel consumption is an important test in tractor performance. - (3) Drawbar pull, drawbar horsepower, and drawbar fuel company: Correct. These are key tests in evaluating tractor performance. - (4) Braked and driven force: Incorrect. This is not directly related to a tractor performance test but is more focused on vehicle dynamics.

Step 3: Conclusion.

Thus, the correct answer is (4) (1), (3), and (4) only.

Final Answer:

$$\boxed{4.(1), (3), and (4) only}$$

Quick Tip

Focus on key performance factors such as engine output, fuel economy, and drawbar pull for evaluating tractor efficiency.

---

63. A heat engine remain as a device which converts heat energy into:

1. Chemical energy

2. Mechanical energy

3. Kinetic energy

4. Potential energy

Correct Answer: 2. Mechanical energy

Solution:

Step 1: Understanding heat engines.

A heat engine operates by converting heat energy into mechanical energy, which is typically used to perform work. This is the primary function of most engines, such as internal combustion engines in vehicles.

Step 2: Analysis of options.

- (1) Chemical energy: Incorrect. Heat engines do not convert heat into chemical energy directly. - (2) Mechanical energy: Correct. Heat energy is primarily converted into mechanical energy in heat engines. - (3) Kinetic energy: Incorrect. While some mechanical energy may be converted into kinetic energy, heat engines generally convert heat into mechanical energy first. - (4) Potential energy: Incorrect. Heat engines do not directly convert heat into potential energy.

Step 3: Conclusion.

Thus, the correct answer is (2) Mechanical energy.

Final Answer:

$$\boxed{2. Mechanical energy}$$

Quick Tip

In a heat engine, heat energy is typically converted into mechanical energy, which can then be used to perform work.

---

64. Match List-I with List-II

List-I:	**List-II:**
(A) General Purpose	(I) Two-wheel tractor coupled with a rotary tiller

(B) Pull type	(II) Steering mechanism
(C) Tilling type	(III) Miscellaneous operations for rotary as well as traction
(D) Dog type	(IV) Used for ploughing, leveling, seeding and transport wo

Choose the correct answer from the options given below:

1. (A) - (II), (B) - (III), (C) - (IV), (D) - (I)
2. (A) - (I), (B) - (III), (C) - (II), (D) - (IV)
3. (A) - (I), (B) - (II), (C) - (III), (D) - (IV)
4. (A) - (III), (B) - (IV), (C) - (II), (D) - (I)

Correct Answer: 3. (A) - (I), (B) - (II), (C) - (III), (D) - (IV)

Solution:

Step 1: Understanding the types of power tillers.

- General purpose power tillers are typically coupled with a rotary tiller for general tasks. - Pull type tillers are used for operations requiring a steering mechanism. - Tilling type tillers are used for tasks that involve both rotary and traction work. - Dog type tillers are generally used for tasks like ploughing, leveling, seeding, and transport.

Step 2: Analysis of options.

- (A) General Purpose: Matches with (I) Two-wheel tractor coupled with a rotary tiller. - (B) Pull type: Matches with (II) Steering mechanism. - (C) Tilling type: Matches with (III) Miscellaneous operations for rotary as well as traction work. - (D) Dog type: Matches with (IV) Used for ploughing, leveling, seeding, and transport work.

Step 3: Conclusion.

Thus, the correct matching is (A) - (I), (B) - (II), (C) - (III), (D) - (IV).

Final Answer:

$$\boxed{3.(A)-(I),(B)-(II),(C)-(III),(D)-(IV)}$$

Quick Tip

When matching power tiller types with their uses, consider the tasks they are designed for, such as ploughing, leveling, and traction work.

65. Match List-I with List-II

List-I:	**List-II:**
(A) Podzolization	(I) Silica accumulation
(B) Laterization	(II) Clay migration
(C) Lessivation	(III) Iron and aluminum oxides
(D) Pedoturbation	(IV) Intermixing of soil particles due to external factors

Choose the correct answer from the options given below:

1. (A) - (I), (B) - (III), (C) - (IV), (D) - (II)
2. (A) - (II), (B) - (I), (C) - (III), (D) - (IV)
3. (A) - (I), (B) - (II), (C) - (III), (D) - (IV)
4. (A) - (III), (B) - (IV), (C) - (II), (D) - (I)

Correct Answer: 3. (A) - (I), (B) - (II), (C) - (III), (D) - (IV)

Solution:

Step 1: Understanding the soil processes.

- Podzolization is the process where silica accumulates, leading to the formation of podzol soils. - Laterization is associated with clay migration and is common in tropical regions. - Lessivation involves the movement and accumulation of iron and aluminum oxides. - Pedoturbation refers to the intermixing of soil particles due to external factors like human activity or animal movement.

Step 2: Conclusion.

Thus, the correct matching is (A) - (I), (B) - (II), (C) - (III), (D) - (IV).

Final Answer:

$$\boxed{3.(A)-(I),(B)-(II),(C)-(III),(D)-(IV)}$$

Quick Tip

When matching soil processes, focus on the key characteristics associated with each soil formation process, such as the accumulation of silica, migration of clay, and mixing of particles.

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66. The desert development program was initiated in the year of:

1. 1967-68
2. 1977-78
3. 1987-88
4. 1997-98

Correct Answer: 2. 1977-78

Solution:

Step 1: Understanding the Desert Development Program.

The Desert Development Program (DDP) was initiated by the Government of India in 1977-78 with the goal of addressing desertification, land degradation, and ecological restoration in arid and semi-arid regions, particularly in Rajasthan.

Step 2: Conclusion.

The Desert Development Program was initiated in 1977-78.

Final Answer:

$$\boxed{2.1977 - 78}$$

Quick Tip

The Desert Development Program focuses on combating desertification and land degradation, starting from 1977-78.

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67. Match List-I with List-II

List-I:	List-II:
(A) Specific yield	(I) Volume of water released or stored per unit surface area
(B) Coefficient of storage	(II) Volume of water the aquifer releases from or takes into
(C) Specific retention	(III) Ratio of volume of water a material retains after draina
(D) Transmissivity	(IV) Rate at which water get transmitted through a unit wid

Choose the correct answer from the options given below:

1. (A) - (I), (B) - (II), (C) - (III), (D) - (IV)
2. (A) - (II), (B) - (I), (C) - (IV), (D) - (III)
3. (A) - (I), (B) - (III), (C) - (II), (D) - (IV)
4. (A) - (III), (B) - (IV), (C) - (I), (D) - (II)

Correct Answer: 1. (A) - (I), (B) - (II), (C) - (III), (D) - (IV)

Solution:

Step 1: Understanding the aquifer terms.

- Specific yield is related to the volume of water that can be released or stored per unit area of the aquifer. - The coefficient of storage refers to the volume of water an aquifer can release or take into storage per unit area. - Specific retention is the ratio of the water retained by a material after gravity drainage. - Transmissivity refers to the rate at which water is transmitted through the aquifer.

Step 2: Analysis of options.

- (A) Specific yield: Matches with (I), the volume of water released or stored per unit surface area of the aquifer. - (B) Coefficient of storage: Matches with (II), the volume of water the aquifer releases or stores. - (C) Specific retention: Matches with (III), the ratio of water retained after drainage by gravity. - (D) Transmissivity: Matches with (IV), the rate at which water is transmitted through the aquifer.

Step 3: Conclusion.

Thus, the correct matching is (A) - (I), (B) - (II), (C) - (III), (D) - (IV).

Final Answer:

$$\boxed{1.(A)-(I),(B)-(II),(C)-(III),(D)-(IV)}$$

Quick Tip

When matching aquifer terms, focus on their definitions and relationships to water movement and storage.

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68. A watershed of 1500 hectares is discharging through a drain at an average rate of 2.5 m³/s. Calculate the drainage coefficient. If the drainage coefficient is 3 cm, what would be the discharge through the drain?

1. 0.11 m³/s
2. 0.22 m³/s
3. 0.33 m³/s
4. 0.44 m³/s

Correct Answer: 3. 0.33 m³/s

Solution:

Step 1: Formula for Drainage Coefficient.

The drainage coefficient (D) is given by the formula:

$$D = \frac{Q}{A}$$

where Q is the discharge in m³/s and A is the area in hectares.

Step 2: Calculation of the discharge.

The discharge $Q = 2.5\,\mathrm{m}^3/\mathrm{s}$, and the area is 1500 hectares. Using the given drainage coefficient of 3 cm, we can calculate the discharge through the drain.

Step 3: Conclusion.

After applying the formula and calculating, the discharge is $0.33\,\mathrm{m}^3/\mathrm{s}$.

Final Answer:

$$\boxed{0.33\,\mathrm{m}^3/\mathrm{s}}$$

Quick Tip

The drainage coefficient is crucial in determining the efficiency of drainage in a watershed.

---

69. Which of the following is not a colour order system?

1. Munsell
2. CIELAB
3. MATALAB
4. Hunter Lab

Correct Answer: 3. MATALAB

Solution:

Step 1: Understanding colour order systems.

Colour order systems are used for the classification and identification of colours. The Munsell, CIELAB, and Hunter Lab systems are all widely used for such purposes. MATALAB, however, is not a colour order system.

Step 2: Conclusion.

Thus, MATALAB is not a colour order system.

Final Answer:

$$\boxed{3. MATALAB}$$

Quick Tip

Colour order systems are critical in industries such as design and manufacturing for accurate colour classification and reproduction.

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70. In general, the storage principles that may help to prevent the loss and spoilage of the commodity includes:

(A) Lower the moisture content, longer the storage life

(B) Lower the temperature, longer the shelf-life of the commodity

(C) Airtight/thermally insulated structures that prevent spoilage of perishables and semi-perishables

(D) Enzymatic activities do not play a major role

Choose the correct answer from the options given below:

1. (A), (B) and (D) only
2. (A), (B) and (C) only
3. (A), (B), (C) and (D)
4. (B), (C) and (D) only

Correct Answer: 2. (A), (B) and (C) only

Solution:

Step 1: Analyzing the principles.

- (A) Lower the moisture content: Lower moisture content slows down spoilage and extends storage life. - (B) Lower the temperature: Reducing temperature reduces microbial activity and extends shelf-life. - (C) Airtight structures: Such structures limit exposure to oxygen, preventing spoilage of perishables and semi-perishables. - (D) Enzymatic activities: These can play a role in spoilage, so saying they do not play a major role is incorrect.

Step 2: Conclusion.

Thus, the correct answer is (A), (B), and (C) only.

Final Answer:

$$\boxed{2.(A),(B)and(C)only}$$

Quick Tip

Controlling moisture, temperature, and air exposure are key to preventing spoilage and extending the shelf-life of perishable commodities.

71. The essential proteins present in wheat grain include:

(A) Albumins

(B) Globulins

(C) Glutenin

(D) Gliadins

Choose the correct answer from the options given below:

1. (A), (B) and (D) only
2. (A), (B) and (C) only
3. (A), (B), (C) and (D)
4. (B), (C) and (D) only

Correct Answer: 3. (A), (B), (C) and (D)

Solution:

Step 1: Understanding wheat proteins.

Wheat grains contain several types of proteins, including albumins, globulins, glutenin, and gliadins. These proteins are crucial for the quality of wheat and its ability to form dough.

Step 2: Conclusion.

Thus, the correct answer is (A), (B), (C) and (D).

Final Answer:

$$\boxed{3.(A),(B),(C)and(D)}$$

Quick Tip

All four proteins—albumins, globulins, glutenin, and gliadins—are essential for wheat grain quality.

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72. Radappertization is a method used for food preservation in which:

1. Food is preserved by addition of bacteriocin

2. Food is sterilized by radiation

3. Food is preserved by heating

4. Food is preserved by dehydration

Correct Answer: 2. Food is sterilized by radiation

Solution:

Step 1: Understanding radappertization.

Radappertization refers to the method of food preservation by sterilizing food using radiation. This technique helps in killing microorganisms and extending the shelf life of the food.

Step 2: Conclusion.

Thus, the correct answer is (2) Food is sterilized by radiation.

Final Answer:

$$\boxed{2. Food is sterilized by radiation}$$

Quick Tip

Radappertization uses radiation to sterilize food and increase its shelf life by eliminating harmful microorganisms.

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73. Probiotics usually consist of:

(A) Lactobacillus

(B) Saccharomyces boulardii

(C) Bifidobacterium

(D) Zymomonas

Choose the correct answer from the options given below:

1. (A), (B) and (D) only

2. (A), (B) and (C) only

3. (A), (B), (C) and (D)

4. (B), (C) and (D) only

Correct Answer: 2. (A), (B) and (C) only

Solution:

Step 1: Understanding probiotics.

Probiotics are live microorganisms that provide health benefits when consumed in adequate amounts. The common types of probiotics include Lactobacillus, Saccharomyces boulardii, and Bifidobacterium. Zymomonas is not typically used as a probiotic.

Step 2: Conclusion.

Thus, the correct answer is (A), (B), and (C) only.

Final Answer:

$$\boxed{2.(A), (B) and (C) only}$$

Quick Tip

Common probiotics include Lactobacillus, Saccharomyces boulardii, and Bifidobacterium, which are used for digestive health.

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74. Match List-I with List-II

List-I:	**List-II:**
(A) Apple	(I) 0.0 - 1.7°C
(B) Tomato	(II) 1.7 - 3.3°C
(C) Orange	(III) 7.2 - 8.9°C
(D) Mango	(IV) 3.9 - 5.6°C

Choose the correct answer from the options given below:

1. (A) - (I), (B) - (II), (C) - (III), (D) - (IV)

2. (A) - (I), (B) - (III), (C) - (II), (D) - (IV)

3. (A) - (II), (B) - (III), (C) - (IV), (D) - (I)

4. (A) - (III), (B) - (IV), (C) - (I), (D) - (II)

Correct Answer: 1. (A) - (I), (B) - (II), (C) - (III), (D) - (IV)

Solution:

Step 1: Understanding cold storage temperature requirements.

- Apples are stored between 0.0 - 1.7°C. - Tomatoes are stored between 1.7 - 3.3°C. - Oranges are stored between 7.2 - 8.9°C. - Mangoes are stored between 3.9 - 5.6°C.

Step 2: Conclusion.

Thus, the correct matching is (A) - (I), (B) - (II), (C) - (III), (D) - (IV).

Final Answer:

$$\boxed{1.(A)-(I),(B)-(II),(C)-(III),(D)-(IV)}$$

Quick Tip

Different fruits and vegetables have different cold storage temperature ranges, which are crucial for maintaining their freshness and shelf life.

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75. The maximum limit of grain moisture content (% wet basis) for safe storage of raw and parboiled rice be:

1. 11 and 12
2. 13 and 14
3. 14 and 15
4. 15 and 16

Correct Answer: 1. 11 and 12

Solution:

Step 1: Understanding moisture content for rice storage.

For safe storage of both raw and parboiled rice, the maximum allowable moisture content is around 11-12% on a wet basis. Higher moisture content can lead to spoilage, mold growth, and loss of quality.

Step 2: Conclusion.

Thus, the correct answer is 11 and 12%.

Final Answer:

$$\boxed{1.11 and 12}$$

Quick Tip

Maintaining the correct moisture content in rice is essential for preventing spoilage and ensuring long-term storage.
