01. A sample of saturated sand has a dry unit weight of 18 kN/m³ and a specific gravity of 2.7. If water is 10 kN/m³, the void ratio of the soil sample will be

(a) 0.5
(b) 0.6
(c) 0.4
(d) 0.9

02. Consistency as applied to cohesive soils is an indicator of its

(a) Density
(b) Moisture content
(c) Shear strength
(d) Porosity

03. Match List! (Unit/Test)..with List II (Purpose) and select the correct answer using the codes

List – I	List – II
A. Cassagrande's apparatus	1. Determination of grain size distribution
B. Hydrometer	2. Consolidation characteristics
C. Plate load test	3. Determination of consistency limits
D. Oedometer	4. Determination of safe bearing capacity of soil

Codes :
a. A – 1, B – 3, C – 2, D – 4
b. A – 1, B – 3, C – 4, D – 2
c. A – 3, B – 1, C – 2, D – 4
d. A – 3, B – 1, C – 4, D – 2

04. Consider the following statements:
1. The minimum value of group index for a soil can be taken as zero.
2. The maximum possible value of group index for a soil is twenty.
Which of the above statements is/are correct?
(a) Both 1 and 2
(b) (b) 1 only
(c) 2 only
(d) Neither 1 nor 2

05. Match List-I with List-II and select the correct answer using the code given below the lists:

List – I	List – II
A. Plate load	1. Specific gravity
B. Pycnometer	2. Bearing capacity
C. Core cutter	3. Grain size
D. Mechanical sieve	analysis
	4. Field density

Codes :
a. A – 3, B – 1, C – 4, D – 2
b. A – 2, B – 1, C – 4, D – 3
c. A – 3, B – 4, C – 1, D – 2
d. A – 2, B – 4, C – 1, D – 3

06. In a wet soil mass, air, occupies one-fourth of its volume and water occupies one-half of its volume. The void ratio of this soil is

a. 1
b. 2
c. 3
d. 4

07. A sand sample has a bulk density of 20 kN/m³ and a degree of saturation of 70%. If the specific gravity of soil grains is 2.65, the value of critical hydraulic gradient for the soil will be

(a) 1.02   (b) 1.05
(c) 1.1 0   (d) 1.15

08. For conducting a Standard Proctor Compaction Test, the weight of hammer (P in kg), the fall of hammer (Q in mm), the number of blows per layer (R) and the number of layers (S) required are respectively

	P	Q	R	S
(a)	5.89	550 50	50	3
(b)	4.89	450 25	25	3
(c)	3.60	310 35	35	4
(d)	2.60	310 25	25	5

09. Sheep-foot rollers are recommended for compacting

(a) granular soils
(b) cohesive soils
(c) hard rock
(d) any type of soil

10. Match List I (Test) with List II (Property) and select the correct answer:

List – I	List – II
A. Proctor Test	1. Grain Size Analysis
B. Vane Test	2. Shear Strength
C. Penetration Test	3. Bearing Capacity
D. Hydrometer Test	4. Compaction

Codes :
A. A – 2, B – 4, C – 1, D – 3
B. A – 4, B – 2, C – 1, D – 3
C. A – 4, B – 2, C – 3, D – 1
D. A – 2, B – 4, C – 3, D – 1

11. Which one of the following organisms is responsible for enteric fever?

(a) ECHO
(b) Salmonella typhi
(c) Entamoeba histolytica
(d) Echinococcus

12. Which of the following cations impart(s) pseudo-hardness to water?

(a) Calcium only
(b) Magnesium only
(c) Calcium and magnesium
(d) Sodium

13. Match List-I (Equipment) with List-II (Parameter) and select the correct answer using the code given below the lists:

List – I	List – II
A. Tintometer	1. Temperature
B. Nephelometer	2. Colour
C. Imhoff one	3. Turbidity
D. Muffle furnace	4. Settleable solids
	5. Volatile solids

Codes :
a. A – 4, B – 3, C – 1, D – 5
b. A – 2, B – 5, C – 4, D – 3
c. A – 4, B – 5, C – 1, D – 3
d. A – 2, B – 3, C – 4, D – 5

14. After which of the following water treatment units, the turbidity is maximum?

(a) Chlorination
(b) Primary sedimentation
(c) Flocculation basin
(d) Secondary sedimentation

15. In context of water polluted with sewage, what does BOD signify?

(a) Biological oxygen demand
(b) Bacteriological oxygen demand
(c) Biochemical oxygen demand
(d) Biology of degradation

16. What is the most common cause of acidity in water?

(a) Carbon monoxide
(b) (b) Nitrogen
(c) Hydrogen
(d) Carbon dioxide

17. The concentration of hardness producing cations may be estimated using which one of the following?

(a) Conductivity meter
(b) (b) pH meter
(c) Spectrophotometer
(d) Flame photometer

18. Which one of the following treatments is economically effective in the control of guinea worm disease?

a. Chlorination
b. Filtration
c. Ozonation
d. Sedimentation

19. Which one of the following tests of water/ wastewater employs Erichrome Black T as an indicator?

a. Hardness
b. COD
c. Residual chlorine
d. DO

20. The maximum safe permissible limit of sulphates in domestic water supply is

(a) 100 mg/l
(b) (b) 200 mg/l
(c) 500 mg/l
(d) 600 mg/l

21. If "Fore bearing" of a line is S 49⁰ 52' E (assuming there is no local attraction), the back bearing of the line will be

(a) S 52⁰ 49' E
(b) S 49⁰ 52' E
(c) N 49⁰ 08' E
(d) N 49⁰ 52' W

22. The direction of the magnetic meridian is established at each traverse station and the direction of the line is determined with reference to the magnetic meridian. This method of traversing is called.

(a) Fast needle method
(b) Loose needle method
(c) Bearing method
(d) Fixed needle method

23. **Assertion (A):**
Whole circle bearing of a line is preferred to a quadrantal bearing.
Reason (R) :
Bearing is completely specified by an angle.

24. The magnetic needle in a prismatic compass is placed

(a) AT the bottom of the graduated aluminium
(b) Above the graduated aluminium ring
(c) Below the brass box
(d) Below the needle lifter, but above the bottom inside the compass

25. The magnetic bearing of a line AB is S 30° E. If the declination is 6° West, then what is the true bearing?
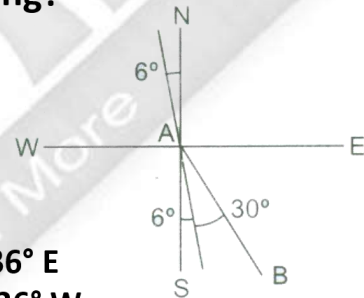
(a) S 36° E
(b) N 36° W
(c) S 24°E
(d) N 24° W

26. Diurnal variation is greater

(a) In winter than in summer
(b) At smaller latitudes than at higher latitudes
(c) At magnetic equator points
(d) In summer than in winter

27. In a closed traverse ABC, following readings were taken

Line	Force bearing	Back bearing
AB	20°	201°
BC	101°	278°
CA	278°	50°

Station A is free from local attraction. Correct bearing of CB is

(a) 275^0
(b) 276^0
(c) 281^0
(d) 280^0

28. If the whole circle bearing is 315^0 20', its quadrantal bearing would be

(a) S 36^0 30' W
(b) N 44^0 40' W
(c) N 57^0 24' W
(d) S 60^0 40' W

29. The needle of a magnetic compass is generally supported on a

(a) Bush bearing
(b) Ball bearing
(c) Needle bearing
(d) Jewel bearing

30. The Whole Circle Bearing of line AB is 50° and of line BC is 120°. The deflection angle at B from AB to BC is

(a) 50°   (b) 70°
(c) 110°   (d) 120°

31. If a hole is made in the Torricelli's vaccum portion of a barometer, then the mercury

a. Level will in the stem and the mercury will collect in the reservoir
b. Level will oscillate between reservoir level and the original level of the mercury in the stem
c. Will spill through the hole made
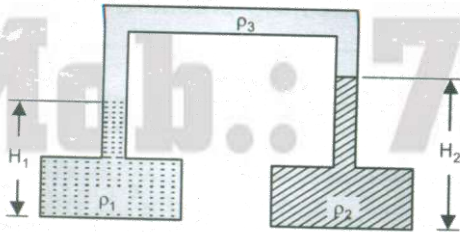d. Level in the stem will remain at the same level indicating atmospheric pressure

32. Multi U-tube manometers with different fluids are used to fluids

a. Low pressure
b. Medium pressure
c. High pressure
d. Very low pressure

33. Which of the following expresses the difference in the pressure at the floors of the tank shown in the figure

   a. $(p_2 - p_1) gH_2$
   b. $(p_2 - p_1) gH_1$
   c. $P_1gH_1 + p_3gH_2 - p_2gH_2 - p_2gH_2$
   d. $P_1gH_1 + p_3g(H_2 - H_1) - p_2gH_2$
   Where p_1 p_2 and p_3 are the densities of the different fluids

34. A right cylinder open at the top is full of water. It is rotated about the vertical axis at such a speed that half the liquid spills out. The pressure at the centre of the bottom would be

   a. One-half of the original magnitude when the cylinder was full
   b. One-fourth of the original magnitude when the cylinder was full
   c. Unchanged
   d. zero

35. If a water tank partially filled with water is being carried on a truck, moving with a constant horizontal acceleration, the level of liquid will

   a. Rise and fall alternately on the front side of the tank
   b. Fall on the rear side of the tank
   c. Remain the same on both sides of the tank
   d. Rise on the rear side and fall on the front side of the tank

36. A symmetrical right-circular cone of wood floats in fresh water with axis vertical and the apex downmost. The axial height of the cone is I the submerged portion has a height h measured upwards from the apex. What would be the height of the centre of buoyancy from the apex.

   a. $\dfrac{h}{2}$ b. $\dfrac{5}{8}h$

   c. $\dfrac{2}{3}h$ d. $\dfrac{3}{4}h$

37. A homogenous circular cylinder of length h, radius r and specific gravity s, floats in water. It is noted that r=2/3 h. under which one of the following conditions will the floatation be unstable

   a. $0.11 \le s < 0.22$
   b. $0.22 \le s < 0.33$
   c. $0.33 \le s < 0.66$
   d. $0.66 \le s < 0.99$

38. A body is floating as shown in the given figure. The centre of buoyancy, centre of gravity and metacentre are labelled respectively as B, G and M the body is
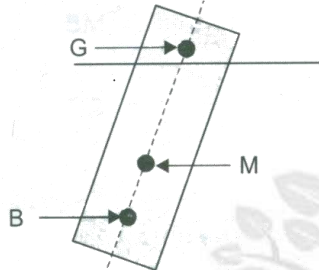
a. Vertically stable
b. Vertically unstable
c. Rotationally stable
d. Rotationally unstable

39. A metal cube of size cm * 15 cm * 15 cm and specific gravity 8.6 is submerged in a two-layered liquid. The bottom layer being mercury and the top layer being water. The percentage of the volume of the cube remaining above the interface will be approximately

a. 68
b. 63
c. 40
d. 25

40. A solid cylinder of length L, diameter D and specific gravity 0.6 floats in neutral equilibrium in water with its axis vertical. what is the ratio of L to D

a. $\sqrt{3}/2$
b. $4/5\sqrt{3}$
c. $2\sqrt{3}/5$
d. $5/4\sqrt{3}$

41. Match List – I with List – II and select the correct answer using the codes given below the lists:

	List – I	List – II
A.	Fineness of cement	1. Le – chatelier apparatus
A.	Setting time	2. Vicat's needle
B.	Soundness	3. Air permeability apparatus
C.	Workability	4. Slump cone

Codes :
a. A – 1, B – 2, C – 3, D – 4
b. A – 3, B – 1, C – 4, D – 2
c. A – 3, B – 2, C – 1, D – 4
d. A – 1, B – 4, C – 3, D – 2

42. If P is the standard consistency of cement the amount of water used in conducting the initial setting time test on cement is

a. 0.65 p
b. 0.85 p
c. 0.6 p
d. 0.8 p

43. **Assertion (A) :**
Pozzolana is added to cement to increase early strength
Reason (R) :
It reduces the heat of hydration.

44. **For complete hydration of cement the w/c ratio needed is**

    a. Less than 0.25
    b. More than 0.25 but less than 0.35
    c. More than 0.35 but less than 0.45
    d. More than 0.45 but less than 0.60

45. Match List – I (Cement mortar for different work) with List – II (Proportion of cement: sand in mortar) and select the correct answer:

List – I	List – I
A. Normal brick works	1. 1 : 4
B. Plastering works	2. 1 : 3
C. Grouting the cavernous rock	3. 1 : 6
D. Guniting	4. 1 : 1.5

    Codes :
    a. A – 1, B – 2, C – 3, D – 4
    b. A – 3, B – 1, C – 2, D – 4
    c. A – 3, B – 1, C – 4, D – 2
    d. A – 4, B – 3, C – 2, D – 1