ANSWERS AND EXPLANATIONS

1. *Ans. (d)*
These cracks occurs from bark to towards sap wood. They are usually formed due to extreme heat or frost during the growth of the tree.

2. *Ans. (d)*
All of the above is correct.
Solid state → Asphalt
Semi fluid → Mineral tar
Fluid state → Petroleum

3. *Ans. (d)*
Gypsum used to increase the setting time of cement where C_3A gives quick setting property to the cement.

4. *Ans. (a)*
Basalt or trap granite are used for railway ballast.

5. *Ans. (a)*
Mud floor is best in winter and summer season to prevent warm and cool respectively.

6. *Ans. (b)*
Putty is made up of powdered chalk and raw linseed oil.

7. *Ans. (c)*
For framework in timber moisture content is 8 - 15%.

8. *Ans. (a)*

Constituents	%
Silica	50 – 60%
Alumina	20 – 30%
Lime	Less than 10%
Iron Oxide	5 – 6%
Magnesia	Less than 1%

**9.** *Ans. (c)*

10. *Ans. (a)*
$\alpha/^\circ C$ for concrete
$$= 3 \times 10^{-4}/^\circ C$$

11. *Ans. (a)*
Check line : Connecting line between two station in survey is called check line. Used to check accuracy of survey.
***Tie Line :*** Line joints two fixed points on the main survey line.
Base Line : Longest main line in a survey is called base line.

12. *Ans. (d)*
IS : 1492 gives specifications of survey chain.

13. *Ans. (b)*
In survey work, it is preferable to use true meridians since they do not vary with time.
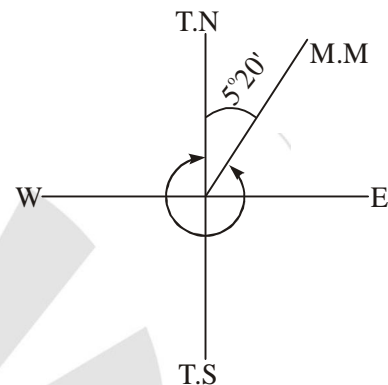
14. *Ans. (d)*

Magnetic bearing of sun at noon is
$= 360^\circ - 5^\circ 20'$
$= 354^\circ 40'$

15. *Ans. (c)*
Instrumental error in compass survey is because of no counter weight provision to counteract dip.

16. *Ans. (c)*
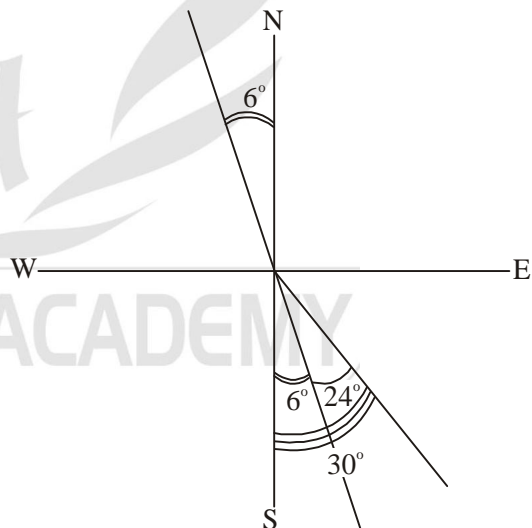
True bearing = Magnetic bearing – Declination
$= S30^\circ E - 6^\circ = S24^\circ E$

17. *Ans. (d)*

18. *Ans. (b)*

$$v = \frac{1}{N}(m)^{2/3} \times (i)^{1/2}$$

It is head loss due to friction in open channel flow.

19. *Ans. (a)*

Prandtl mixing length is zero at the pipe wall.

20. *Ans. (c)*

Eddy viscosity for turbulent flow is dependent on the flow.

21. *Ans. (c)*

$$\tau = \left(\frac{\partial p}{\partial x}\right)\cdot\frac{R}{z}$$

$$\tau = \left(-\frac{60}{15}\right)\times\frac{15}{100}\times\frac{1}{2}$$

$$\tau = 0.3 \text{ Kilopascal}$$

22. *Ans. (c)*

$$\tau_{max} = \frac{1}{2}\sqrt{(\sigma_x - \sigma_y)^2 + 4\tau_{xy}^2}$$

$$= \frac{1}{2}\sqrt{(-40-40)^2 + 4\times30^2}$$

$$= \frac{1}{2}\sqrt{1000} = 50 \text{ MPa}$$

23. *Ans. (c)*

Resistance strain gauge is the device which is used to measure normal stress on the surface of a stressed object.

24. *Ans. (c)*

25. *Ans. (b)*

It is 8P, when diameter of shaft subjected to torque alone is double.

26. *Ans. (a)*

Flexural rigidity = EI

and its dimension is ML^3T^{-2}.

27. *Ans. (b)*

Elongation is measured with the help of extensometer while loads are measured on the main dial.

28. *Ans. (c)*

$$\mu = \frac{3K - 2G}{6K + 2G}$$

29. *Ans. (d)*   **30.** *Ans. (b)*

31. *Ans. (a)*   **32.** *Ans. (c)*

33. *Ans. (d)*   **34.** *Ans. (a)*

35. *Ans. (b)*   **36.** *Ans. (a)*

37. *Ans. (b)*   **38.** *Ans. (c)*

39. *Ans. (d)*   **40.** *Ans. (a)*

41. *Ans. (b)*

42. *Ans. (b)*

Applying KVL in the loop

$24 - 1i + 2V_b - V_b - 4i = 0$
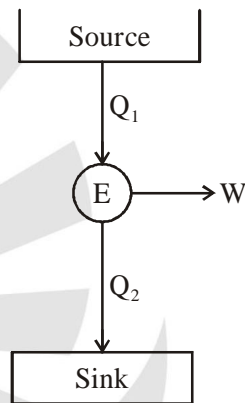
where $V_b = 3i$

$\Rightarrow 24 - 5i + V_b = 0$

$\Rightarrow 24 - 5i + 3i = 0$

$i = 12A$

43. *Ans. (c)*

44. *Ans. (d)*

45. *Ans. (c)*

46. *Ans. (c)*

Such a heat engine is PMM2 which is impossible. It violates kelvin-plank statement.

47. *Ans. (b)*

The work output of the carnot engine

$$= Q_1 - Q_2$$

$= \frac{1}{4} \times$ heat transferred to the cold system

$$= \frac{1}{4}Q_2$$

Hence, $Q_1 = Q_2 + \frac{Q_2}{4} = \frac{5Q_2}{4}$

Efficiency of the cycle

$$= \frac{Q_1 - Q_2}{Q_2} = \frac{\left(\frac{5Q_2}{4}\right) - Q_2}{Q_2} = \frac{1}{4} \text{ or } 25\%$$

48. *Ans. (b)*

49. *Ans. (b)*

Speed ratio $= \frac{u}{\sqrt{2gH}}$

$u = 0.48 \times \sqrt{2\times9.81\times256} = 34.02$ m/sec

But $u = \left(\frac{\pi DN}{60}\right)$

$$D = \frac{60\times34.02}{\pi\times630} = 1.03 \text{ m}$$

50. *Ans. (d)*

A francis turbine is an reaction turbine.