21. Two forces of equal magnitude P are acting at an angle of 30° with each other. The resultant of the two forces is

    1. 2P

    2. $P\sqrt{3}$

    3. $P/\sqrt{3}$

    4. 3P

22. A block of mass 50 kg resting on a plane inclined at 30° to the horizontal is just about to slide down. The friction force exerted by the plane on the block is

    1. W

    2. W/2

    3. 2W

    4. $W/\sqrt{3}$

23. What is the force acting at the point A of the lamp post shown in the figure?
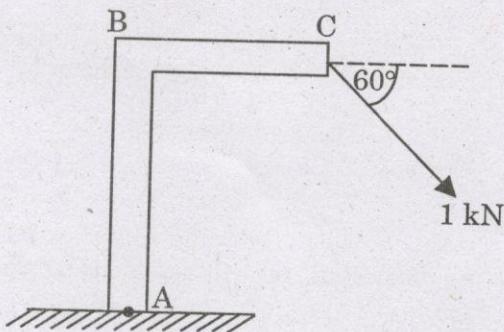

    1. 0.866 kN

    2. 0.5 kN

    3. 1.388 kN

    4. 1 kN

24. The moment of inertia of the triangular area about the x-axis is
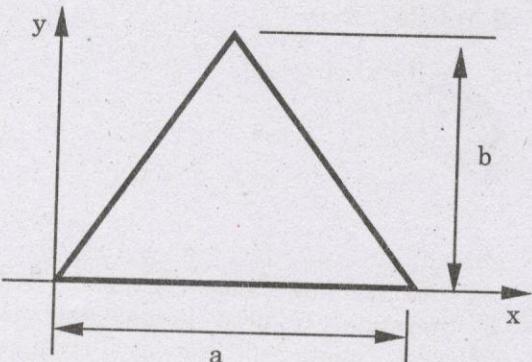
    1. $\dfrac{ba^3}{12}$

    2. $\dfrac{ab^3}{12}$

    3. $\dfrac{ab^3}{3}$

    4. $\dfrac{ba^3}{3}$

25. If the end of the cable at A is pulled down with a speed of 2 m/s, determine the speed at which block B arises
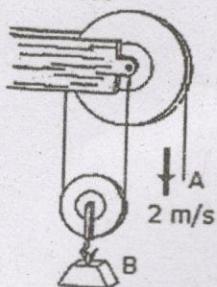
    1. $v_B = 4.00$ m/s ↓

    2. $v_B = 1.000$ m/s ↑

    3. $v_B = 1.000$ m/s ↓

    4. $v_B = 4.00$ m/s ↑

26. In a non-flow reversible process for which $p = (-2v + 15) \times 10^5 \text{ N/m}^2$, v changes from 1 m³ to 2 m³. The work done is
    1. 100×10^5 J
    2. 120×10^5 J
    3. 12×10^5 J
    4. 12×10^5 kJ

27. Work done in a free expansion process
    1. Positive
    2. Zero
    3. Minimum
    4. Negative

28. In SI units, the value of the universal gas constant is
    1. 0.08314 bar.m³ / kgmole.K
    2. 0.8314 J / mole.K
    3. 83.14 KPa.m³ / kgmole.K
    4. 83.14 J / mole.K

29. Kelvin – Planck's law deals with
    1. Conservation of energy
    2. Conservation heat
    3. Conversion of work into heat
    4. Conversion of heat into work

30. The efficiency of a Carnot engine depends on
    1. Working Substance
    2. On the temperatures of both the source and the sink
    3. On the temperature of the source only
    4. On the temperature of the sink only

31. In brittle materials with atomically sharp cracks, the stress concentration at the tip of the crack is
    1. $20\,\sigma$
    2. $200\,\sigma$
    3. $10^4\,\sigma$
    4. $10^5\,\sigma$

32. The ferroelectric behavior of $BaTiO_3$ ceases above its ferroelectric Curie temperature because the unit cell transforms from
    1. cubic to tetragonal
    2. cubic to hexagonal
    3. tetragonal to cubic
    4. hexagonal to cubic

33. For silicon doped with B,
    1. $n_e \gg n_h$
    2. $n_h \gg n_e$
    3. $n_h \gg n_i$
    4. $n_h \gg n_e$ and $n_h \gg n_i$

34. A certain person speaking normally produces a sound intensity level of 40 dB at a distance of 1.0 m. If the threshold intensity for reasonable audibility is 20 dB, how far away can the person be heard clearly?
    1. 10 m
    2. 1.414 m
    3. 2 m
    4. 100 m

35. The Bravais lattice types for a given crystal system are P, I and F. The crystal system is
    1. monoclinic
    2. orthorhombic
    3. tetragonal
    4. cubic

36. A mixture of yellow light of wavelength 5800 Å and blue light of wavelength 4500 Å is incident normally on an air film 0.00029 mm thick. The colour of the reflected light is
    1. red
    2. blue
    3. violet
    4. green

37. A capillary tube of diameter 0.5 mm is inserted in water with surface tension 0.078 N/m. The capillary rise in the capillary tube in mm is
    1. 63.6 mm
    2. 24.8 mm
    3. 55.4 mm
    4. 75 mm

38. A jet of water issuing from a nozzle of diameter 75 mm with a velocity of 10 m/s is impinging a stationery flat plate. The force acting on the flat plate due to jet impingement is
    1. 662.7 N
    2. 441.8 N
    3. 365.3 N
    4. 756.3 N

39. The velocities at two points in a boundary layer at distances 0.2 m and 0.3 m are 0.4 m/s and 0.5 m/s respectively. Find the wall shear stress if the fluid is water.
   1. 5.2 N/m²
   2. 7.5 N/m²
   3. 9.7 N/m²
   4. 10.2 N/m²

40. A pumping system is driven by a electrical motor whose rotational speed is 1440 rpm. The discharge and head at peak efficiency is found to be 30 litres per second and 50 m respectively. The specific speed of the pump is
   1. 45
   2. 13.3
   3. 24.5
   4. 144

41. Municipal solid waste with a high paper and wood content has
   1. low calorific value
   2. high calorific value
   3. high toxic content
   4. high protein content

42. The current I supplied by the dc voltage source in the circuit shown below is
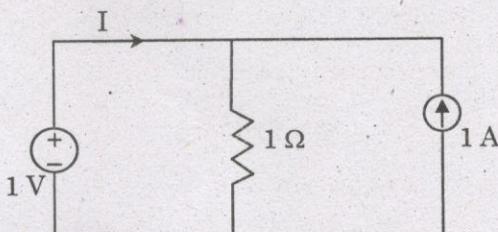
   1. 0 A
   2. 0.5 A
   3. 1 A
   4. 2 A

43. While measuring power of a three-phase balanced load by the two-wattmeter method, the readings are 100 W and 250 W. The power factor of the load is
   1. 0.5
   2. 0.6
   3. 0.7
   4. 0.8

44. An ideal voltage source should have
   1. large value of emf
   2. small value of emf
   3. zero source resistance
   4. infinite source resistance

45. To determine the polarity of the voltage drop across the resistor, it is necessary to know
   1. Value of the current through the R
   2. Direction of current through R
   3. Value of R
   4. Emf in the circuit

46. A non-linear network does not satisfy
   1. superposition condition
   2. homogeneity condition
   3. both homogeneity as well as superposition condition
   4. homogeneity, superposition and associative condition

47. Two processors A and B have clock frequencies of 700 Mhz and 900 Mhz respectively. Suppose A can execute an instruction with an average of 3 steps and B can execute with an average of 5 steps. For the execution of the same instruction which processor is faster?
   1. A
   2. B
   3. Both take the same time
   4. Insufficient information

48. What will be the output at PORT1 if the following program is executed?

MVI B, 82H

MOV A, B

MOV C, A

MVI D, 37H

OUT PORT1

HLT
   1. 37H
   2. 82H
   3. B9H
   4. 00H

49. What is the output of the following program? (Assume that the appropriate pre-processor directives are included and there is no syntax error)

```
main( )
{
    char S[ ] = "ABCDEFGH";
        printf ("%C",* (& S[3]));
        printf ("%s", S+4);
        printf ("%u", S);
    /* Base address of S is 1000 */
}
```

1. ABCDEFGH1000
2. CDEFGH1000
3. DDEFGHH1000
4. DEFGH1000

50. The correct statement for a function that takes pointer to a float, a pointer to a pointer to a char and returns a pointer to a pointer to a integer is

1. int **fun(float**, char**)
2. int *fun(float*, char*)
3. int ***fun(float*, char**)
4. int ***fun(*float, **char)

51. In reversed-phase HPLC

1. a hydrophobic stationary phase is combined with a polar mobile phase
2. hydrophilic stationary phase is combined with a non-polar mobile phase
3. a hydrophobic stationary phase is combined with a non-polar mobile phase
4. a hydrophilic stationary phase is combined with a polar mobile phase

52. The rate constant, the activation energy and the Arrhenius parameter of chemical reaction at 25°C are 3×10^{-4} s^{-1}, 104.4 kJ mol^{-1} and 6×10^{14} s^{-1} respectively. The value of the rate constant as $t \to \infty$ is

1. 2.0×10^{18} s^{-1}
2. 6×10^{14} s^{-1}
3. Infinity
4. 3.6×10^{30} s^{-1}

53. Which of the following is a poor conductor of electricity?

1. CH_3COONa
2. C_2H_5OH
3. $NaCl$
4. KOH

54. Which of the following bonds would show the strongest absorption in the IR?

1. carbon-hydrogen
2. nitrogen-hydrogen
3. oxygen-hydrogen
4. sulfur-hydrogen

55. The knocking tendency in compression-ignition engines increases with

1. Decrease of compression ratio
2. Increase of compression ratio
3. Increasing the temperature of inlet air
4. Increasing cooling water temperature