NEET UG (2024)
Physics
Quiz-8

SECTION – A

1. The vector $\vec{P} = a\hat{i} + a\hat{j} + 3\hat{k}$ and $\vec{Q} = a\hat{i} - 2\hat{j} - \hat{k}$ are perpendicular to each other. The positive value of *a* is:

(1) 3 (2) 2

(3) 1 (4) zero

2. The vectors $\vec{A}$ and $\vec{B}$ are such that $|\vec{A} + \vec{B}| = |\vec{A} - \vec{B}|$. The angle between vectors $\vec{A}$ and $\vec{B}$ is -

(1) 90° (2) 60°

(3) 75° (4) 45°

3. Two vectors of equal magnitude have a resultant equal to either of them in magnitude. The angle between them is:

(1) 60° (2) 90°

(3) 105° (4) 120°

4. A force $\vec{F} = (3\hat{i} + 4\hat{j})$ newton acts on a body and displaces it by $\vec{S} = (3\hat{i} + 4\hat{j})$ metre. The work done $(W = \vec{F}.\vec{S})$ by the force is:

(1) 10 J (2) 12 J

(3) 19 J (4) 25 J

5. The vector sum of two forces is perpendicular to their vector difference. In that case, the force:

(1) Are equal to each other

(2) Are equal to each other in magnitude

(3) Are not equal to each other in magnitude

(4) Cannot be predicted

6. Which of the following is not a physical quantity?

(1) Time (2) Current

(3) Hotness (4) Temperature

7. If a vector $(2\hat{i} + 3\hat{j} + 8\hat{k})$ is perpendicular to the vector $(4\hat{j} - 4\hat{i} + \alpha\hat{k})$, then the value of α is:

(1) –1 (2) 1/2

(3) –1/2 (4) 1

8. If $|\vec{A} \times \vec{B}| = \sqrt{3}\ \vec{A}\cdot\vec{B}$, then the value of $|\vec{A} + \vec{B}|$ is:

(1) $\left(A^2 + B^2 = \frac{AB}{\sqrt{3}}\right)^{1/2}$

(2) $A + B$

(3) $\left(A^2 + B^2 + \sqrt{3}AB\right)^{1/2}$

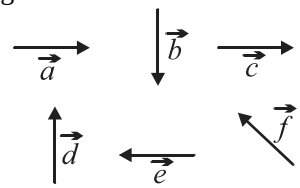
(4) $(A^2 + B^2 + AB)^{1/2}$

9. Which of following is a fundamental physical quantity?

(1) Angle (2) Charge

(3) Temperature (4) Inertia

10. Six vectors, $\vec{a}$ through $\vec{f}$ have the magnitudes and directions indicated in the figure. Which of the following statements is true?



(1) $\vec{b} + \vec{e} = \vec{f}$ (2) $\vec{b} + \vec{c} = \vec{f}$

(3) $\vec{d} + \vec{c} = \vec{f}$ (4) $\vec{d} + \vec{e} = \vec{f}$

11. If the magnitude of sum of two vectors is equal to the magnitude of difference of the two vectors, the angle between these vectors is:

(1) 0° (2) 90°

(3) 45° (4) 180°

12. 'Parsec' is the unit of -

(1) Time (2) Distance

(3) Frequency (4) Angular acceleration

13. The ratio of the dimension of Planck's constant and that of the moment of inertia is the dimension of :-

(1) Velocity (2) Angular momentum

(3) Time (4) Frequency

14. Dimension of electrical resistance is ;-

(1) [ML2T–3A–1] (2) [ML2T–3A–2]

(3) [ML3T–3A–2] (4) [ML–1L3T3A2]

15. kg m/s is a unit of

(1) Energy (2) Momentum

(3) Force (4) Pressure

16. The velocity v of a particle at time t is given by $v = at + \frac{b}{t-c}$, where a, b and c are constants. The dimensions of a, b and c are respectively :-
(1) LT^{-2}, L and T
(2) L^2, T and LT^2
(3) LT^2, LT and L
(4) L, LT and T^2

17. Current can be expressed as a derived in terms of any of the following
(1) Length & mass
(2) Time & temperature
(3) Mass & time
(4) None of these

18. If the dimensions of a physical quantity are given by $M^aL^bT^c$, then the physical quantity will be:
(1) Force if $a = 0$, $b = -1$, $c = -2$
(2) Pressure if $a = 1$, $b = -1$, $c = -2$
(3) Velocity if $a = 1$, $b = 0$, $c = -1$
(4) Acceleration if $a = 1$, $b = 1$, $c = -2$

19. Candela is the unit of
(1) Sound intensity
(2) Luminous intensity
(3) Charge
(4) Energy

20. Dimension of magnetic permeability is:
(1) MLT^2A^{-2}
(2) $ML^{-1}T^{-2}A^{-2}$
(3) $ML^{-2}T^{-2}A^2$
(4) $MLT^{-2}A^{-2}$

21. What is the dimensions of magnetic field B in terms of C = coulomb, M, L and T -
(1) $M^1L^1T^{-2}C$ (2) $M^1L^0T^{-1}C^{-1}$
(3) $M^1L^0T^{-2}C$ (4) $M^1L^0T^{-1}C$

22. The density of a material in CGS system of units is 4 g/cm^3. In a system of units in which unit of length is 10 cm and unit of mass is 100 g, the value of density of material will be :-
(1) 0.04 (2) 0.4
(3) 40 (4) 400

23. The dimensions of $(\mu_0 \in_0)^{1/2}$ are :-
(1) $[L^{1/2}T^{1/2}]$ (2) $[L^{-1}T]$
(3) $[LT^{-1}]$ (4) $[L^{1/2}T^{-1/2}]$

24. The splitting of a vector into two component vectors is called _____
(1) Vector resolution
(2) Vector sum
(3) Vector decomposition
(4) Vector difference

25. What is the standard form for the resolution of a vector having magnitude 'a' and is inclined at an angle θ to the X axis?
(1) $a\left(\cos\theta\hat{i} + \sin\theta\hat{j}\right)$
(2) $a\left(\sin\theta\hat{i} + \cos\theta\hat{j}\right)$
(3) $a\left(\sin\theta\hat{i} + \sin\theta\hat{j}\right)$
(4) $a\left(\cos\theta\hat{i} + \cos\theta\hat{j}\right)$

26. What is the resolved form for a vector which is 5 units in long and is inclined at an angle of 45 degrees to the X axis?
(1) $\frac{1}{\sqrt{2}}\hat{i} + \frac{1}{\sqrt{2}}\hat{j}$ (2) $\frac{5}{\sqrt{2}}\hat{i} + \frac{5}{\sqrt{2}}\hat{j}$
(3) $\frac{5}{\sqrt{2}}\hat{i} + \frac{15}{\sqrt{2}}\hat{j}$ (4) $\frac{10}{\sqrt{2}}\hat{i} + \frac{10}{\sqrt{2}}\hat{j}$

27. A velocity vector (5 m/s) is making and angle of 60 degrees with X axis has a horizontal component of magnitude ___
(1) 2.5 (2) 5.5
(3) 5 (4) 10/√3

28. A force vector (50 N) is making and angle of 30 degrees with X axis has a vertical component of magnitude ___
(1) 25 (2) 55
(3) 50 (4) 100/√3

29. A vector is represented as $4\hat{i} + 3\hat{j}$. What is its magnitude?
(1) 5 (2) 10
(3) 4 (4) 3

30. A vector can be resolved along _____
(1) Only one direction
(2) Only two directions
(3) Only three directions
(4) Only in independent directions

31. The equation of state of some gases can be expressed as $\left(P + \frac{a}{V^2}\right)(V - b) = RT$, where P is the pressure, V is the volume, T is the absolute temperature and a, b & R are constants. The dimensions of 'a' are :-
(1) $[ML^5T^{-2}]$
(2) $[ML^{-1}T^{-2}]$
(3) $[L^3]$
(4) $[L^6]$

32. Which of the following system of units is not based on units of mass, length and time alone
(1) SI (2) MKS
(3) FPS (4) CGS

33. The physical quantity which has dimensional formula as that of $= \frac{\text{Energy}}{\text{Mass} \times \text{Length}}$ is

(1) Force (2) Power
(3) Pressure (4) Acceleration

34. Which of the following pairs does not have similar dimensions?

(1) Tension and surface tension
(2) Stress and pressure
(3) Plank's constant and angular momentum
(4) Angle and strain

35. The dimension of torque are:

(1) $[ML^3L^{-3}]$ (2) $[ML^{-1}T^{-1}]$
(3) $[ML^2T^{-2}]$ (4) $[ML^{-3}]$

SECTION - B

36. A force F is given by $F = at + bt^2$, where t is time. What are the dimensions of a and b

(1) $[MLT^{-3}$ and $ML^2T^{-4}]$
(2) $[MLT^{-3}$ and $LMT^{-4}]$
(3) $[MLT^{-1}$ and $MLT^0]$
(4) $[MLT^{-4}$ and $MLT^1]$

37. Two quantities A and B have different dimensions. Which mathematical operation given below is physically meaningful

(1) A/B (2) $A + B$
(3) $A - B$ (4) None of these

38. The dimension of the ratio of angular to linear momentum is

(1) $[M^0L^1T^0]$ (2) $[M^1L^1T^{-1}]$
(3) $[M^1L^2T^{-1}]$ (4) $[M^{-1}L^{-1}T^{-1}]$

39. If the error in the measurement of the radius of a sphere is 2%, then the error in the determination of the volume of the sphere will be:

(1) 4% (2) 6%
(3) 8% (4) 2%

40. A Screw Guage gives the following readings when used to measure the diameter of a wire. Main scale reading = 0.0 mm. Circular scale reading = 52 divisions. Given that: 1 mm on the main scale corresponds to 100 divisions of the circular scale. The diameter of the wire from the above data is:

(1) 0.026 cm
(2) 0.005 cm
(3) 0.52 cm
(4) 0.052 cm

41. In a vernier calliper, N division of vernier scale coincide with (N – 1) divisions of main scale (in which length of one division is 1 mm). The least count of the instrument should be

(1) N mm (2) (N – 1) mm
(3) $\frac{1}{10\,\text{N}}$ cm (4) $\frac{1}{(\text{N}-1)}$ mm

42. A student measures the distance traversed in free fall of a body, initially at rest in a given time. He uses this data to estimate g, the acceleration due to gravity. If the maximum percentage errors in measurement of the distance and the time are e_1 and e_2 respectively, the percentage error in the estimation of g is

(1) $e_1 - e_2$
(2) $e_1 + 2e_2$
(3) $e_1 + e_2$
(4) $e_1 - 2e_2$

43. In an experiment four quantities a, b, c and d are measured with percentage error 1%, 2%, 3% and 4% respectively. Quantity P is calculated as follows $P = a^3b^2/cd$%, error in P is

(1) 14% (2) 10%
(3) 7% (4) 4%

44. Unit of stress is

(1) N/m (2) N-m
(3) N/m^2 (4) $N\text{-}m^2$

45. If force (F), velocity (v) and time (T) are taken as fundamental units, then the dimensions of mass are

(1) $[FvT^{-1}]$
(2) $[FvT^{-2}]$
(3) $[Fv^{-1}T^{-1}]$
(4) $[Fv^{-1}T]$

46. If the unit of length and force be increased four times, then the unit of energy is

(1) Increased 4 times
(2) Increased 8 times
(3) Increased 16 times
(4) Decreased 16 times

47. Of the following quantities, which one has dimensions different from the remaining three

(1) Energy per unit volume
(2) Force per unit area
(3) Product of voltage and charge per unit volume
(4) Angular momentum per unit mass

48. **Assertion:** Parallex method cannot be used for measuring distances of stars more than 100 light years away.

Reason: Because parallex angle reduces so much that it cannot be measured accurately.

(1) If both Assertion and Reason are true and Reason is the correct explanation of Assertion
(2) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion
(3) If Assertion is true but Reason is false
(4) If both Assertion and Reason are false

49. **Assertion:** Number of significant figures in 0.005 is one and that in 0.500 is three.

Reason: This is because zeros are not significant.

(1) If both Assertion and Reason are true and Reason is the correct explanation of Assertion

(2) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion

(3) If Assertion is true but Reason is false

(4) If both Assertion and Reason are false

50. **Assertion:** Mass, length and time are fundamental physical quantities.

Reason: They are independent of each other.

(1) If both Assertion and Reason are true and Reason is the correct explanation of Assertion

(2) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion

(3) If Assertion is true but Reason is false

(4) If both Assertion and Reason are false

Solution

1. **(1)**

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$\vec{P}.\vec{Q} = 0 \Rightarrow \left(a\hat{i} + a\hat{j} + 3\hat{k}\right).\left(a\hat{i} - 2\hat{j} - \hat{k}\right) = 0$

$a^2 - 2a - 3 = 0 \Rightarrow (a - 3)\,(a + 1) = 0 \Rightarrow a = 3, -1$

2. **(1)**

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$\left|\vec{A} + \vec{B}\right|^2 = \left|\vec{A} - \vec{B}\right|^2$

$\Rightarrow \quad A^2 + B^2 + 2AB\cos\theta = A^2 + B^2 - 2AB\cos\theta$

$\Rightarrow \quad \cos\theta = 0$

$\Rightarrow \quad \theta = 90°$

3. **(4)**

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$R = 2a\cos\theta/2$

$\Rightarrow \quad \cos\theta/2 = ½$

$\Rightarrow \quad \theta/2 = 60°$

$\Rightarrow \quad \theta = 120°$

4. **(4)**

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$W = \vec{F}.\vec{S}. = \left(3\hat{i} + 4\hat{j}\right).\left(3\hat{i} + 4\hat{j}\right) = 9 + 16 = 25\ \text{J}$

5. **(2)**

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$\left(\vec{A} + \vec{B}\right).\left(\vec{A} - \vec{B}\right) = 0$

$\Rightarrow \quad A^2 - \vec{A}.\vec{B} + \vec{B}.\vec{A} - B^2 = 0$

$\Rightarrow \quad A = B\left(\because \vec{A}.\vec{B} = \vec{B}.\vec{A}\right)$

6. **(3)**

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Hotness is form of temp.

7. **(3)**

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$\left(2\hat{i} + 3\hat{j} + 8\hat{k}\right).\left(4\hat{j} - 4\hat{i} + \alpha\hat{k}\right) = 0$

$-8 + 12 + 8\alpha = 0$

$\Rightarrow \quad 8\alpha = -4$

$\alpha = -1/2$

$\cos\theta = \dfrac{1}{2} \Rightarrow \theta = 60°$

8. **(4)**

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$\left|\vec{A} \times \vec{B}\right| = \sqrt{3}\vec{A}.\vec{B} \Rightarrow AB\sin\theta = \sqrt{3}AB\cos\theta$

$\Rightarrow \quad \tan\theta = \sqrt{3} \Rightarrow \theta = 60°$

$R = \sqrt{A^2 + B^2 + 2AB\cos 60°} = \left(A^2 + B^2 + AB\right)^{1/2}$

9. **(3)**

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10. **(4)**

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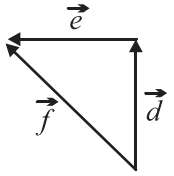

$\Rightarrow \quad \vec{f} = \vec{d} + \vec{e}$

11. **(2)**

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12. **(2)**

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13. **(4)**

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14. **(2)**

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Power = t^2R

$\dfrac{\text{Work done}}{\text{Time}} = \dfrac{\text{Force} \times \text{Distance}}{\text{Time}}$

$\Rightarrow \quad [R] = \left[\dfrac{\text{ML}^2\text{T}}{\text{T}}\right]\left[\dfrac{1}{A^2}\right]$

$\Rightarrow \quad [R] = \text{ML}^2\text{T}^{-3}\text{A}^{-2}.$

15. **(2)**

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kg m/s

mass (Length/Time)

mass × velocity = momentum

16. **(1)**

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$v = at + \dfrac{b}{t - c}$

Dimensionally, $at = v$

$\Rightarrow \quad a[\text{T}] = [\text{LT}^{-1}] \Rightarrow a = [\text{LT}^{-2}]$

$c = t \Rightarrow c = [\text{M}^0\text{L}^0\text{T}^1]$

$\dfrac{b}{t + c} = v \Rightarrow \dfrac{b}{T} = [\text{LT}^{-1}] \Rightarrow b = [\text{M}^0\text{L}^1\text{T}^0]$

17. (4)

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Current = Ampere

18. (2)

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[Force] = [MLT^{-2}]

[Pressure] = [$ML^{-1}T^{-2}$]

[Velocity] = [LT^{-1}]

[Acceleration] = [LT^{-2}]

19. (2)

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Luminous – intensity

20. (4)

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Force per unit length between two parallel current carrying wires is given by

$$\frac{F}{l}=\frac{\mu_0 1_1 1_2}{2\pi d}$$

$$\therefore \quad [\mu_0]=\left[\frac{F}{I^2}\right]=\left[\frac{MLT^{-2}}{A^2}\right]=\left[MLT^{-2}A^{-2}\right]$$

21. (2)

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Magnetic field = [$M^1T^{-2}A^{-1}$]

[C] = [AT] $\Rightarrow$ [A] = [CT^{-1}]

B = [$M^1L^0T^{-1}C^{-1}$]

22. (3)

NCERT XIth, Page -33

Density of material

$$=4\frac{g}{cm^3}=\frac{4\times1000}{100}\frac{100g}{(10cm)^3}=40\frac{(100g)}{(10cm)^3}$$

=40

23. (3)

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$(\mu_0 \in_0)^{-1/2}$ = C = speed of light

$(\mu_0 \in_0)^{-1/2}$ = [L^1T^{-1}]

24. (1)

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The splitting of a vector into two component vectors is called vector resolution. The vector can be resolved into as many components as there are independent directions.

25. (1)

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The correct answer is $a\left(\cos\theta\hat{i}+\sin\theta\hat{j}\right)$. This is obtained by constructing a right-angled triangle with the distance of the point from the origin with either of the axes and then finding out the corresponding values for X and Y components.

26. (2)

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The standard for is $a\left(\cos\theta\hat{i}+\sin\theta\hat{j}\right)$. Here, a = 5, and θ = 45 degrees. When we substitute this in the equation, we get, the resolved vector as $\frac{5}{\sqrt{2}}\hat{i}+\frac{5}{\sqrt{2}}\hat{j}$.

27. (1)

NCERT XIth, Page -69

The horizontal component of any vector with magnitude a is a cos θ. Here θ = 60. cos θ = 1/2. Hence the answer is 5/2 = 2.5 m/s.

28. (1)

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The vertical component of any vector with magnitude a is a sin θ. Here θ = 60. sin θ = 1/2. Hence the answer is 50/2 = 25 N.

29. (1)

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The magnitude of any vector can be found by taking the square root of sum of the squares of its two components. Hence, the sum of the squares of components is equal to $4^2 + 3^2 = 25$. Square root of 25 = 5. Hence, the answer is 5.

30. (4)

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A vector can be resolved in number of components. But, the number of components has to be equal to the number of independent directions available. It can only be resolved into independent directions no matter how many they are.

31. (1)

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$\frac{a}{V^2}$ is dimensionally equal to P

$\frac{a}{\left(L^3\right)^2}$ = [$M^1L^{-1}T^{-2}$]

$\Rightarrow$ a = [$M^1L^5T^{-2}$]

32. (1)
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33. (4)
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$$\frac{\text{Energy}}{\text{mass} \times \text{length}} = \frac{ML^2T^{-2}}{M \times L} = LT^{-2}\ (m/s^2)$$

34. (1)
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35. (3)
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$\vec{\tau} = \vec{r} \times \vec{F}$

Dimensional for torque $\vec{\tau} = [L^1]\ [M^1L^1T^{-2}]$

$= [M^1L^2T^{-2}]$

36. (2)
NCERT XIth, Page -32

$A = B + C$

$F = at$

$MLT^{-2} = at$

$a = MLT^{-3}$

$F = at + bt^2$

$bt^2 = F$

$$b = \frac{F}{t^2} = \frac{MLT^{-2}}{T^2}$$

$b = MLT^{-4}$

37. (1)
NCERT XIth, Page -32

Same dimensional quantities add or subtract.

38. (1)
NCERT XIth, Page -32

$P = mv$

$L = mvR$

$$\frac{L}{p} = \frac{mvR}{mv} = R \to L \Rightarrow \left[M^0L^1T^0\right]$$

39. (2)
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40. (4)
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41. (3)
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42. (2)
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43. (1)
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44. (3)
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45. (4)
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46. (3)
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47. (4)
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48. (1)
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As the distance of star increases, the parallax angle decreases, and great degree of accuracy is required for its measurement. Keeping in view the practical limitation in measuring the parallax angle, the maximum distance of a star we can measure is limited to 100 light year.

49. (3)
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Since zeros placed to the left of the number are never significant, but zeros placed to right of the number are significant.

50. (1)
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As length, mass and time represent our basic scientific notations, therefore they are called fundamental quantities and they cannot be obtained from each other.