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PREFACE

Target's **'NEET (UG) Physics Test Series'** is a complete practice book, extremely handy for the preparation of NEET (UG) examinations. This book would act as a go-to tool for preparation and practice at the same time.

The core objective of the book is to help students gauge their preparedness to appear for NEET (UG) Examination, as it includes a beautiful assortment of MCQ's in the form of Topic Tests and Revision Tests along with Model Test Papers as per latest paper pattern. Topic Tests are provided for powerful concept building.

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All Test Papers in this book have been created in line with the examination pattern and touches upon all the conceptual nodes of the subject.

We have provided answers to all the questions along with detailed solutions for difficult questions.

We are sure that, these question papers would provide ample practice to students in a systematic manner and would boost their confidence to face the challenges posed in examinations.

We welcome your valuable suggestions and feedback towards this book.

We wish the students all the best for their examinations!

- Publisher

Edition: First

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Disclaimer

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This work is purely inspired by the paper pattern prescribed by NTA (National Testing Agency). Every care has been taken in the publication of this reference book by the Authors while creating the contents. The Authors and the Publishers shall not be responsible for any loss or damages caused to any person on account of errors or omissions which might have crept in or disagreement of any third party on the point of view expressed in the reference book.

NEW PAPER PATTERN

- **Paper Pattern NEET (UG)-2021**

  The Paper Pattern of NEET (UG)-2021 comprises of subjects - Physics, Chemistry and Biology (Botany and Zoology). Each subject will consist of two sections. Section A will consist of 35 Questions and Section B will have 15 questions. Out of these 15 Questions, candidates can choose to attempt any 10 Questions.

  The New Paper Pattern for the **NEET (UG)-2021** Examination is as follows:

Sr. No.	Subject(s)	Section(s)	No. of Questions(s)	Mark(s) (Each Question Carries 04 (Four) Marks)	Type of Questions(s)
1.	Physics	Section A	35	140	MCQ (Multiple Choice Questions)
		Section B	*15	40	
2.	Chemistry	Section A	35	140	
		Section B	*15	40	
3.	Botany	Section A	35	140	
		Section B	*15	40	
4.	Zoology	Section A	35	140	
		Section B	*15	40	
		Total Marks		**720**	

** Only the first 10 attempted questions from out of 15 will be considered for evaluation.*

Important points to note for Section A & B:

i. Each question carries 04 (four) marks and, for each correct answer candidate will get 04 (four) marks.

ii. For each incorrect answer, 01(one) mark will be deducted from the total score.

iii. To answer a question, the candidate has to find, for each question, the correct answer/ best option.

iv. In case of the challenge of key, if more than one option is found to be correct then all/any one of the multiple correct/best options marked will be given four marks (+4). However, unanswered/unattempted questions will be given no marks.

v. In case, a question is dropped/ ignored, all candidates will be given four marks (+4) irrespective of the fact whether the question has been attempted or not attempted by the candidate.

- **Mode of Examination:**

  NEET (UG) – 2021 is a Pen & Paper-based Test, to be answered on the specially designed machine gradable OMR sheet using Ball Point Pen.

- **Duration of Examination:**

  The duration of the examination would be **three (03) hours**.

INDEX

Topic Test 01

Physical world and measurement, Scalars and vectors

Time: 1 Hour **Total Marks: 200**

1. If L and C denote the inductance and capacitance respectively, then the dimensional formula for LC will be
   (A) $[M^2]$ (B) $[T^2]$
   (C) $[A^{-2}]$ (D) $[L^{-2}]$

2. The length of a beam is 0.6×10^3 m, the order of magnitude of the length of the beam is
   (A) 10^4 (B) 10^2 (C) 10^3 (D) 10^5

3. **Assertion:** Nuclear radii can be measured by Fermi unit.
   Reason: Micron and angstrom are not considered as correct unit to measure nuclear radii as these are larger units.
   (A) Assertion is True, Reason is True; Reason is a correct explanation for Assertion.
   (B) Assertion is True, Reason is True; Reason is not a correct explanation for Assertion.
   (C) Assertion is True, Reason is False.
   (D) Assertion is False, Reason is True.

4. What vector must be added to the sum of two vectors $4\hat{i}-2\hat{j}+3\hat{k}$ and $3\hat{i}+\hat{j}-\hat{k}$, so that the resultant may be a unit vector along negative y-axis?
   (A) $3\hat{i}-4\hat{j}+\hat{k}$ (B) $-2\hat{i}+\hat{j}-6\hat{k}$
   (C) $-7\hat{i}-2\hat{k}$ (D) $-6\hat{i}+9\hat{j}$

5. The dimensional representation of latent heat is identical to that of
   (A) angular momentum.
   (B) gravitational potential.
   (C) electric potential.
   (D) internal energy.

6. Verifying if the velocity (v) of electromagnetic wave is directly proportional to the wavelength of the wave (λ), the density of air (ρ) and time (t), choose the correct relation between the quantities.
   (A) $v \propto \lambda t^{-1}$ (B) $v \propto \lambda\rho^{-1}t$
   (C) $v \propto \lambda^{-1}\rho^{-2}t$ (D) $v \propto \lambda\rho t^{-1}$

7. If $l = 4.221$ cm, b = 2.1 cm, then l + b is equal to
   (A) 6.31 cm (B) 6 cm
   (C) 6.62 cm (D) 6.3 cm

8. If $\vec{P}\times\vec{Q}=0$, then two vectors $\vec{P}$ and $\vec{Q}$ are
   (A) parallel to each other.
   (B) perpendicular to each other.
   (C) at an angle 60°.
   (D) at an angle 120°.

9. Two points A and B in space have the co-ordinates (1, –1, 2) and (4, 2, 5) respectively. Find vector AB.
   (A) $\hat{i}+\hat{j}-\hat{k}$ (B) $2\left(-\hat{i}-\hat{j}-\hat{k}\right)$
   (C) $3\left(\hat{i}+\hat{j}-\hat{k}\right)$ (D) $4\left(\hat{i}-\hat{j}+\hat{k}\right)$

10. What will be magnitude of two forces if their magnitudes are in the ratio 1:2, the angle between their direction is 30° and magnitude of their resultant force is 30 N?
    (A) 10.31 N, 20.62 N (B) 9.63 N, 18.64 N
    (C) 6.22 N, 12.44 N (D) 1.26 N, 3.13 N

11. Joule/second is equal to
    (A) watt (B) pascal
    (C) tesla (D) farad

12. **Assertion:** The sum of the vectors $\vec{P}$ and $\vec{Q}$ is equal to the sum of their unit vectors $\hat{P}$ and $\hat{Q}$.
    Reason: $\vec{P}$ is equal to $\vec{Q}$.
    (A) Assertion is True, Reason is True; Reason is a correct explanation for Assertion.
    (B) Assertion is True, Reason is True; Reason is not a correct explanation for Assertion.
    (C) Assertion is True, Reason is False.
    (D) Assertion is False, Reason is True.

13. If R, σ, M and K denotes Rydberg constant, electrical conductivity, magnetic dipole moment and dielectric constant, then dimensions of $\frac{R^2\sigma}{MK^4}$ will be
    (A) $[M^1L^1T^2A^{-4}]$ (B) $[M^1L^2T^{-4}A^{-1}]$
    (C) $[M^{-2}L^{-5}T^{-3}A^{-2}]$ (D) $[M^{-1}L^{-7}T^3A^1]$

14. The vector projection of $3\hat{j}-4\hat{k}$ on x-axis is
    (A) 7 (B) 4
    (C) zero (D) 3

15. The dimensions of k in the equation $E = \frac{1}{2}kx^2$ is
    (A) $[M^{-2}L^{-1}T^{-2}]$ (B) $[M^1T^{-1}]$
    (C) $[M^1T^{-2}]$ (D) $[M^1L^2T^{-1}]$

16. The length of a simple pendulum is about 90 cm known to an accuracy of 2 mm. A clock of resolution 0.2 s is used to measure time for 200 oscillations. If period of oscillation of simple pendulum is 2 s, then what is the accuracy in the determined value of g?
    (A) 20 % (B) 50 %
    (C) 10 % (D) 30 %

17. If the radius of a sphere is (6.3 ± 0.3), then the percentage error in the volume of the ball will be
(A) 14.28 % (B) 15.46 %
(C) 28.65 % (D) 8.43 %

18. The velocity of a particle travelling in a straight line is given by $v = pt + qt^2 + r$. Find the dimensions of q if p, q, r are constants.
(A) $[L^1M^1T^1]$ (B) $[L^2M^1T^2]$
(C) $[L^1M^0T^{-3}]$ (D) $[L^2M^0T^{-2}]$

19. The force F is expressed in terms of mass (m) and time (t) as $F = \alpha m + \beta t^2$. The dimensions of $\frac{\alpha}{\beta}$ are
(A) $[M^2T^{-4}]$ (B) $[M^1L^1T^{-2}]$
(C) $[M^1T^{-1}]$ (D) $[M^{-1}T^2]$

20. The physical quantity is given by $P = M^{\alpha}L^{\beta}T^{\gamma}$. The percentage error in the measurement of M, L and T are a, b and c respectively. Then maximum percentage error in P is
(A) $\frac{\alpha\beta}{c}+\frac{\beta\gamma}{a}+\frac{\gamma\alpha}{b}$ (B) $\alpha a + \beta b + \gamma c$
(C) $\frac{\alpha}{a}+\frac{\beta}{b}+\frac{\gamma}{c}$ (D) $\alpha^a + \beta^b + \gamma^c$

21. $[M^1L^2T^{-2}\theta^{-1}]$ are the dimensions of _______.
(A) Rydberg constant
(B) Universal gas constant
(C) Boltzmann constant
(D) Stefan's constant

22. Which of the following is a scalar?
(A) Energy of thermal neutron
(B) Electric field
(C) Velocity of air
(D) Torque

23. If $\vec{p} = 4\hat{i} - 9\hat{j}$, $\vec{q} = 6\hat{i} + 9\hat{k}$ and $\vec{r} = 4\hat{j} + 2\hat{k}$, then the unit vector $\hat{R}$ along the direction of sum of these vectors will be
(A) $\frac{1}{\sqrt{111}}(6\hat{i} - 19\hat{j} + 2\hat{k})$
(B) $\frac{1}{\sqrt{288}}(2\hat{i} - 9\hat{j} + 14\hat{k})$
(C) $\frac{1}{\sqrt{164}}(11\hat{j} - 9\hat{i} + 12\hat{k})$
(D) $\frac{1}{\sqrt{246}}(10\hat{i} - 5\hat{j} + 11\hat{k})$

24. What will be the direction of resultant force on the body if it is acted up by these forces $\vec{F}_1 = 2\hat{i} - 4\hat{j} + 9\hat{k}$, $\vec{F}_2 = -2\hat{i} - 5\hat{j} + 6\hat{k}$ and $\vec{F}_3 = 4\hat{i} - 9\hat{j} + 2\hat{k}$?
(A) Along x-axis
(B) Along y-axis
(C) Along z-axis
(D) Along all three axes

25. What will be direction of cosines of the vector $\vec{P}$ if $\vec{P} = 2\hat{i} - 4\hat{j} + 3\hat{k}$?
(A) $\frac{2}{\sqrt{29}}, \frac{-4}{\sqrt{29}}$ and $\frac{3}{\sqrt{29}}$
(B) $\frac{4}{\sqrt{46}}, \frac{3}{\sqrt{46}}$ and $\frac{2}{\sqrt{46}}$
(C) $\frac{1}{\sqrt{59}}, \frac{2}{\sqrt{59}}$ and $\frac{5}{\sqrt{59}}$
(D) $\frac{4}{\sqrt{19}}, \frac{3}{\sqrt{19}}$ and $\frac{-2}{\sqrt{19}}$

26. The angular diameter of a planet is 2000″. If the distance of the planet from the earth is 2×10^{12} m, then the linear diameter of the planet is
(A) 1.94×10^{10} m (B) 2.64×10^{9} m
(C) 1.64×10^{12} m (D) 2.11×10^{8} m

27. If $\vec{A} = 4\hat{i} + 6\hat{j}$, $\vec{B} = 4\hat{j} - \hat{k}$ and $\vec{C} = 6\hat{i} + 2\hat{k}$, then value of $\vec{A} + 2\vec{B} - \vec{C}$ would be
(A) $6\hat{i} - 9\hat{j} + 8\hat{k}$ (B) $2\hat{i} - 14\hat{j} + 4\hat{k}$
(C) $6\hat{i} - 14\hat{j} + 9\hat{k}$ (D) $-2\hat{i} + 14\hat{j} - 4\hat{k}$

28. $Wm^{-2}K^{-4}$ is a unit of
(A) Wein's constant
(B) Boltzmann constant
(C) Stefan's constant
(D) Gas constant

29. The magnitude of rectangular components of $\vec{R}$ along the x, y and z axes of a three dimensional rectangular cartesian co-ordinates system are 2 units, 3 units and 4 units respectively. Find the magnitude of resultant vector $\vec{R}$.
(A) $\sqrt{29}$ (B) $\sqrt{19}$ (C) $\sqrt{39}$ (D) $\sqrt{59}$

30. $0.1\hat{i} + 0.2\hat{j} + x\hat{k}$ represents a unit vector when x is
(A) 0.62 (B) 0.97 (C) 0.81 (D) 0.33

31. Which of the following represents a vector of magnitude 10 units?
(A) $\hat{P}$ = 10 unit (B) $|\hat{P}|$ = 10 unit
(C) $|\vec{P}|$ = 10 unit (D) $\vec{P}$ = 10 unit

32. Find the value of 40 J on the system based on 30 cm, 2 kg and 0.5 minute as fundamental units.
(A) 8×10^3 units (B) zero
(C) 8×10^5 units (D) 8×10^4 units

33. **Assertion:** Thermal conductivity of a substance depends upon transfer of heat through it.
Reason: The dimension of thermal conductivity is $[M^1L^1T^{-3}\theta^{-1}]$.
(A) Assertion is True, Reason is True; Reason is a correct explanation for Assertion.
(B) Assertion is True, Reason is True; Reason is not a correct explanation for Assertion.
(C) Assertion is True, Reason is False.
(D) Assertion is False, Reason is True.

34. What are the dimensions of inter-atomic force?
(A) $[M^1L^2T^1]$ (B) $[M^1T^1]$
(C) $[M^2L^1T^{-1}]$ (D) $[M^1T^{-2}]$

35. $x = \alpha\,(1 + e^{-\beta t})$, where x is distance and t is time. Then β is
(A) distance (B) frequency
(C) velocity (D) time

36. The unit vector parallel to the resultant of the vectors $\vec{P} = 3\hat{i} + 2\hat{j} - 6\hat{k}$ and $\vec{Q} = 2\hat{i} + \hat{j}$ is
(A) $\frac{1}{\sqrt{20}}\left(6\hat{i} + 9\hat{j} - 9\hat{k}\right)$
(B) $\frac{1}{\sqrt{70}}\left(5\hat{i} + 3\hat{j} - 6\hat{k}\right)$
(C) $\frac{1}{49}\left(5\hat{j} + 7\hat{k}\right)$
(D) $\frac{1}{8}\left(6\hat{i} - 4\hat{j} + 9\hat{k}\right)$

37. $[L^0M^0T^0]$ is dimensional formula of _______.
(A) Planck's constant
(B) coefficient of linear expansion
(C) mechanical equivalent of heat
(D) Rydberg constant

38. The SI units of specific heat is
(A) Joule (B) Joule/kg-K
(C) Joule/K (D) Joule/mole-K

39. The wavelength of light is 60 micron. Its value in metre is
(A) 0.000006 m (B) 0.06 m
(C) 0.00006 m (D) 0.0006 m

40. Magnitude of emf of an inductor is given by $|e| = L\frac{dI}{dt}$, the dimension of emf is
(A) $[M^1L^2T^{-3}A^{-1}]$ (B) $[M^1L^1T^{-2}A^{-3}]$
(C) $[M^1L^{-2}T^1A^1]$ (D) $[M^2L^2T^{-1}A^{-4}]$

41. If the error encountered while performing experiment is due to fluctuation of voltage then, the most possible error will be
(A) system error.
(B) personal error.
(C) random error.
(D) instrumental error.

42. Magnetic induction B at the centre of a circular coil of radius r when current I flows through it, is given by $B = \frac{\mu_0}{4\pi}\frac{2I}{r}$ the dimensions of μ_0 will be
(A) $[M^1L^1T^{-2}A^{-2}]$ (B) $[M^1L^0T^{-1}A^{-1}]$
(C) $[M^0L^1T^{-2}A^{-3}]$ (D) $[M^1L^1T^{-4}A^{-1}]$

43. **Assertion:** Out of the four measurements x = 0.5 m, x = 0.50 m, x = 0.500 m and x = 0.5000 m, the last one is more accurate.
Reason: In every measurement, only the last significant digit is not accurately known.
(A) Assertion is True, Reason is True; Reason is a correct explanation for Assertion.
(B) Assertion is True, Reason is True; Reason is not a correct explanation for Assertion.
(C) Assertion is True, Reason is False.
(D) Assertion is False, Reason is True.

44. The value of force in C.G.S. system was noted as 150 dyne. In SI system the fundamental quantities are kilogram, metre and second, the magnitude of force is
(A) 150×10^{-3} N (B) 15.0×10^{-3} N
(C) 1500×10^{-3} N (D) 1.5×10^{-3} N

45. The physical quantity P is given by $P = \frac{a^2b^2}{c^3\sqrt{d}}$, the percentage error in measurement of a, b, c and d are 2%, 3%, 1% and 2% respectively. What is the percentage error in P?
(A) 8% (B) 12%
(C) 14% (D) 10%

46. The displacement vector due to end points (2,4,0) and x is $6\hat{i} - 9\hat{j} + \hat{k}$. What is the magnitude of $\vec{x}$ from origin?
(A) $3\sqrt{10}$ (B) $4\sqrt{7}$
(C) $9\sqrt{5}$ (D) $2\sqrt{10}$

47. If torque is equal to the product of force and displacement, then what is dimensional formula for torque?
(A) $[M^1L^2T^{-2}]$ (B) $[M^2L^1T^{-1}]$
(C) $[M^1L^1T^{-2}]$ (D) $[M^1L^2T^1]$

48. The velocity of a racing car recorded by four sensors are 150 m/s, 151 m/s, 152 m/s and 149 m/s respectively. The average absolute error is
(A) 0.2 m/s (B) 1 m/s
(C) 0.5 m/s (D) 2 m/s

49. Match the following:

	PHYSICAL QUANTITY		DIMENSIONS
1.	Specific gravity	i.	$[M^0L^0T^{-1}]$
2.	Angular frequency	ii.	$[M^1L^{-1}T^{-1}]$
3.	Energy density	iii.	$[M^0L^0T^0]$
4.	Coefficient of viscosity	iv.	$[M^1L^{-1}T^{-2}]$

(A) 1–(i), 2–(iii), 3–(iv), 4–(ii)
(B) 1–(ii), 2–(i), 3–(iv), 4–(iii)
(C) 1–(iv), 2–(iii), 3–(i), 4–(ii)
(D) 1–(iii), 2–(i), 3–(iv), 4–(ii)

50. The length and breadth of a metal sheet are 4.28 m and 2.06 m respectively. The area of the sheet upto correct significant figures is
(A) 8.83 m^2 (B) 8.82 m^2
(C) 8.816 m^2 (D) 8.817 m^2

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To see complete chapter buy **Target Notes** or **Target E-Notes**

Topic Test – 01

1. (B)	2. (C)	3. (A)	4. (C)	5. (B)	6. (A)	7. (D)	8. (A)	9. (C)	10. (A)
11. (A)	12. (D)	13. (D)	14. (C)	15. (C)	16. (A)	17. (A)	18. (C)	19. (D)	20. (B)
21. (B)	22. (A)	23. (D)	24. (D)	25. (A)	26. (A)	27. (D)	28. (C)	29. (A)	30. (B)
31. (C)	32. (C)	33. (B)	34. (D)	35. (B)	36. (B)	37. (C)	38. (B)	39. (C)	40. (A)
41. (C)	42. (A)	43. (A)	44. (D)	45. (C)	46. (A)	47. (A)	48. (B)	49. (D)	50. (B)

Topic Test - 02

1. (C)	2. (C)	3. (A)	4. (C)	5. (D)	6. (D)	7. (B)	8. (C)	9. (A)	10. (B)
11. (A)	12. (A)	13. (D)	14. (D)	15. (B)	16. (D)	17. (B)	18. (B)	19. (A)	20. (D)
21. (D)	22. (D)	23. (C)	24. (B)	25. (D)	26. (B)	27. (B)	28. (D)	29. (B)	30. (C)
31. (A)	32. (D)	33. (A)	34. (A)	35. (D)	36. (A)	37. (B)	38. (C)	39. (A)	40. (C)
41. (A)	42. (B)	43. (A)	44. (B)	45. (A)	46. (B)	47. (D)	48. (A)	49. (B)	50. (A)

Topic Test - 03

1. (B)	2. (B)	3. (B)	4. (B)	5. (C)	6. (C)	7. (A)	8. (A)	9. (A)	10. (D)
11. (D)	12. (B)	13. (C)	14. (B)	15. (A)	16. (A)	17. (A)	18. (D)	19. (A)	20. (B)
21. (C)	22. (C)	23. (B)	24. (D)	25. (B)	26. (C)	27. (A)	28. (A)	29. (D)	30. (B)
31. (D)	32. (B)	33. (A)	34. (B)	35. (B)	36. (D)	37. (C)	38. (D)	39. (A)	40. (A)
41. (B)	42. (C)	43. (D)	44. (A)	45. (A)	46. (C)	47. (D)	48. (C)	49. (B)	50. (C)

Revision Test - 01

1. (D)	2. (A)	3. (C)	4. (A)	5. (C)	6. (D)	7. (B)	8. (D)	9. (B)	10. (C)
11. (B)	12. (D)	13. (A)	14. (B)	15. (A)	16. (A)	17. (D)	18. (D)	19. (D)	20. (A)
21. (B)	22. (B)	23. (A)	24. (D)	25. (B)	26. (A)	27. (A)	28. (D)	29. (D)	30. (B)
31. (D)	32. (B)	33. (B)	34. (B)	35. (B)	36. (B)	37. (D)	38. (B)	39. (D)	40. (B)
41. (D)	42. (B)	43. (C)	44. (A)	45. (B)	46. (D)	47. (A)	48. (A)	49. (B)	50. (A)

Topic Test - 04

1. (A)	2. (A)	3. (C)	4. (C)	5. (C)	6. (B)	7. (C)	8. (D)	9. (A)	10. (A)
11. (A)	12. (C)	13. (C)	14. (B)	15. (D)	16. (B)	17. (D)	18. (B)	19. (C)	20. (B)
21. (A)	22. (A)	23. (B)	24. (A)	25. (C)	26. (B)	27. (D)	28. (A)	29. (D)	30. (D)
31. (A)	32. (A)	33. (A)	34. (B)	35. (A)	36. (A)	37. (B)	38. (B)	39. (B)	40. (B)
41. (D)	42. (D)	43. (B)	44. (A)	45. (B)	46. (C)	47. (D)	48. (D)	49. (B)	50. (B)

Topic Test - 05

1. (D)	2. (A)	3. (C)	4. (B)	5. (C)	6. (C)	7. (C)	8. (A)	9. (B)	10. (B)
11. (B)	12. (B)	13. (A)	14. (C)	15. (C)	16. (B)	17. (B)	18. (B)	19. (A)	20. (C)
21. (A)	22. (A)	23. (A)	24. (A)	25. (B)	26. (B)	27. (A)	28. (B)	29. (A)	30. (B)
31. (C)	32. (D)	33. (B)	34. (D)	35. (A)	36. (D)	37. (B)	38. (B)	39. (C)	40. (C)
41. (C)	42. (D)	43. (B)	44. (C)	45. (A)	46. (A)	47. (A)	48. (B)	49. (B)	50. (D)

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Topic Test - 01

1. (B)
$L = [M^1L^2T^{-2}A^{-2}]$
$C = [M^{-1}L^{-2}T^4A^2]$
$LC = [T^2]$

2. (C)

3. (A)

4. (C)
Let $\vec{R}$ be the vector to be added.
$\therefore \left(4\hat{i}-2\hat{j}+3\hat{k}\right)+\left(3\hat{i}+\hat{j}-\hat{k}\right)+\vec{R}=-\hat{j}$
$7\hat{i}-\hat{j}+2\hat{k}+\vec{R}=-\hat{j}$
$\vec{R} = -7\hat{i}-2\hat{k}$

5. (B)

6. (A)
$v \propto \lambda^x \rho^y t^z$
$v = k\,\lambda^x \rho^y t^z$
$[M^0L^1T^{-1}] = [M^0L^1T^0]^x\,[M^1L^{-3}T^0]^y\,[M^0L^0T^1]^z$
….(Here, k is constant of proportionality and is dimensionless.)
$[M^0L^1T^{-1}] = [L^x]\,[M^yL^{-3y}]\,[T^z]$
$[M^0L^1T^{-1}] = [L^{x-3y}M^yT^z]$
$\Rightarrow$ y = 0,
Also, (x – 3y = 1) $\Rightarrow$ x = 1 and –1 = z
$\therefore$ z = –1
$\therefore v \propto \lambda^1\rho^0t^{-1}$
$v \propto \lambda t^{-1}$

7. (D)
l = 4.221 cm
= 4.2 cm (rounding off upto one decimal places)
b = 2.1 cm
l + b = 4.2 + 2.1 = 6.3 cm

8. (A)
$\vec{P}\times\vec{Q}=0$
$\therefore$ PQ sin θ = 0
$\therefore$ sin θ = 0
$\Rightarrow$ θ = 0°
Two vectors will be parallel to each other.

9. (C)
$\vec{OB} = \vec{OA}+\vec{AB}$
$AB = OB - OA$
$\vec{OA} = \hat{i}-\hat{j}+2\hat{k}$
$\vec{OB} = 4\hat{i}+2\hat{j}+5\hat{k}$
$\vec{AB} = 4\hat{i}+2\hat{j}+5\hat{k}-\hat{i}+\hat{j}-2\hat{k}$
$\vec{AB} = 3\hat{i}+3\hat{j}-3\hat{k}$
$\vec{AB} = 3\left(\hat{i}+\hat{j}-\hat{k}\right)$

10. (A)
Let $\vec{P}$ and $\vec{Q}$ be the two forces,
$|\vec{P}|$ = x, $|\vec{Q}|$ = 2x, R = 30 N and θ = 30°
$|\vec{R}| = \sqrt{P^2+Q^2+2PQ\cos\theta}$
$30 = \sqrt{x^2+(2x)^2+2(x)(2x)\cos 30°}$
$\therefore 30 = \sqrt{5x^2+2\sqrt{3}x^2}$
$\therefore$ x = 10.31 N
Forces are
P = x = 10.31 N and
Q = 2x = 2 × 10.31 = 20.62 N

11. (A)
Power = $\frac{\text{work}}{\text{time}}$
watt = $\frac{\text{joule}}{\text{second}}$

12. (D)
Sum of two vectors cannot be equal to sum of their unit vectors $\vec{P}+\vec{Q} \neq \hat{P}+\hat{Q}$

13. (D)
$$\left[\frac{R^2\sigma}{MK^4}\right] = \frac{\left[M^0L^{-1}T^0\right]^2\left[M^{-1}L^{-3}T^3A^2\right]}{\left[M^0L^2T^0A^1\right]\left[M^0L^0T^0\right]^4}$$
$$= \frac{\left[M^{-1}L^{-5}T^3A^2\right]}{\left[M^0L^2T^0A^1\right]} = [M^{-1}L^{-7}T^3A^1]$$

14. (C)
As the multiple of $\hat{i}$ in the given vector is zero, this vector lies in yz plane and projection of this vector on x-axis is zero.

15. (C)
$E = \frac{1}{2}kx^2$
$k = \frac{[E]}{[x^2]} = \frac{[ML^2T^{-2}]}{L^2} = [MT^{-2}]$

16. (A)
Time period of a simple pendulum is given by
$T = 2\pi\sqrt{\frac{l}{g}}$
$\therefore T^2 = \frac{4\pi^2 l}{g}$
or $g = \frac{4\pi^2 l}{T^2}$ ….(i)
Taking logs and differentiating equation (i), we get
$\frac{\Delta g}{g} = \frac{\Delta l}{l} - \frac{2\Delta T}{T}$

For maximum relative error, the individual errors should be added up.

$\therefore \quad \frac{\Delta g}{g} = \frac{\Delta l}{l} + \frac{2\Delta T}{T}$

$\frac{\Delta g}{g} = \frac{0.2}{90} + 2 \times \frac{0.2}{2}$

$\frac{\Delta g}{g} = 0.002 + 0.2$

$\frac{\Delta g}{g} = 0.202$

% error in g is given by,

$\frac{\Delta g}{g} \times 100 = 0.202 \times 100 = 20\ \%$

17. (A)

Percentage error = $3\frac{\Delta r}{r} \times 100$

....($\because$ volume of a sphere $= \frac{4}{3}\pi r^3$)

$= 3 \times \frac{0.3}{6.3} \times 100$

$= 14.28\ \%$

18. (C)

By homogeneity of dimensions of LHS and RHS,

velocity = qt^2

$m/s = q \times s^2$

$q = m/s^3$

$q = [L^1M^0T^{-3}]$

19. (D)

$\alpha m = F$

$\alpha = \frac{F}{m} = \frac{[L^1M^1T^{-2}]}{M^1}$

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

$\beta t^2 = F$

$\beta = \frac{F}{t^2} = \frac{[L^1M^1T^{-2}]}{[T^2]} = [L^1M^1T^{-4}]$

$\frac{\alpha}{\beta} = \frac{[L^1T^{-2}]}{[L^1M^1T^{-4}]}$

$\frac{\alpha}{\beta} = [M^{-1}T^2]$

20. (B)

Percentage error in $P = \alpha a + \beta b + \gamma c$

21. (B)

$[R] = \left[\frac{PV}{T}\right] = \left[\frac{M^1L^{-1}T^{-2} \times L^3}{\theta}\right]$

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

22. (A)

23. (D)

$\vec{R} = \vec{p} + \vec{q} + \vec{r}$

$= 4\hat{i} - 9\hat{j} + 6\hat{i} + 9\hat{k} + 4\hat{j} + 2\hat{k} = 10\hat{i} - 5\hat{j} + 11\hat{k}$

$\hat{R} = \frac{\vec{R}}{|R|} = \frac{10\hat{i} - 5\hat{j} + 11\hat{k}}{\sqrt{10^2 + 5^2 + 11^2}} = \frac{1}{\sqrt{246}}(10\hat{i} - 5\hat{j} + 11\hat{k})$

24. (D)

25. (A)

$\vec{P} = 2\hat{i} - 4\hat{j} + 3\hat{k}$

$\therefore \quad |\vec{P}| = \sqrt{(2)^2 + (-4)^2 + (3)^2} = \sqrt{29}$

$\therefore \quad \cos\alpha = \frac{2}{\sqrt{29}}$,

$\cos\beta = \frac{-4}{\sqrt{29}}$,

$\cos\gamma = \frac{3}{\sqrt{29}}$

26. (A)

Distance of planet from earth's = 2×10^{12} m

Angular diameter of planet, θ

$= 2000'' = \left(\frac{2000}{60 \times 60}\right)^{\circ} = \frac{2000}{3600} \times \frac{\pi}{180}$ rad

Diameter of planet, $D = s \times \theta$

$= 2 \times 10^{12} \times \frac{2000}{3600} \times \frac{\pi}{180}$

$D \approx 1.94 \times 10^{10}$ m

27. (D)

$\vec{A} + 2\vec{B} - \vec{C} = 4\hat{i} + 6\hat{j} + 2(4\hat{j} - \hat{k}) - (6\hat{i} + 2\hat{k})$

$= 4\hat{i} + 6\hat{j} + 8\hat{j} - 2\hat{k} - 6\hat{i} - 2\hat{k}$

$= -2\hat{i} + 14\hat{j} - 4\hat{k}$

28. (C)

Stefan's constant (σ)

$\sigma = \frac{E}{T^4} = $ watt/m^2-K^4

29. (A)

$R = \sqrt{R_x^2 + R_y^2 + R_z^2} = \sqrt{2^2 + 3^2 + 4^2} = \sqrt{29}$

30. (B)

$\sqrt{(0.1)^2 + (0.2)^2 + x^2} = 1$

$\therefore \quad x = 0.97$

31. (C)

32. (C)

$40\ J = \frac{40\,kgm^2}{s^2} = \frac{40 \times 2\ kg \times (100\ cm)^2}{(1\ s)^2}$

$= \frac{40 \times 2 \times (100/30)^2}{(1/30)^2} = 8 \times 10^5$ units

33. (B)

$$\Delta Q = KA\left(\frac{T_1 - T_2}{L}\right)\Delta t$$

$$[K] = \frac{[M^1L^2T^{-2}][L]}{[L^2][\theta][T]} = [M^1L^1T^{-3}\theta^{-1}]$$

34. (D)

$k = Y \times r_0$

where, Y = Young's modulus,

r_0 = inter-atomic distance.

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

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

35. (B)

The power of exponent is always dimensionless.

$\therefore\ [\beta t] = [M^0L^0T^0]$

$$[\beta] = \left[\frac{1}{t}\right] = \frac{1}{[M^0L^0T^1]}$$

$\beta = [M^0L^0T^{-1}]$

β = frequency

36. (B)

Resultant of $\vec{P}$ and $\vec{Q}$, $\vec{R} = \vec{P} + \vec{Q}$

$= 3\hat{i} + 2\hat{j} - 6\hat{k} + 2\hat{i} + \hat{j}$

$= 5\hat{i} + 3\hat{j} - 6\hat{k}$

$$\hat{R} = \frac{\vec{R}}{|\vec{R}|} = \frac{5\hat{i} + 3\hat{j} - 6\hat{k}}{\sqrt{5^2 + 3^2 + 6^2}} = \frac{5\hat{i} + 3\hat{j} - 6\hat{k}}{\sqrt{70}}$$

37. (C)

Mechanical equivalent of heat

$$= \frac{\text{Amount of Work (W)}}{\text{Heat (Q)}} = \frac{[M^1L^2T^{-2}]}{[M^1L^2T^{-2}]} = [M^0L^0T^0]$$

38. (B)

$$\text{Specific heat} = \frac{Q}{m\theta} = \frac{\text{Joule}}{\text{kg} - \text{K}}$$

39. (C)

60 microns = 60×10^{-6} m = 0.00006 m

40. (A)

$$|e| = L\frac{dI}{dt}$$

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

$dI = [A^1]$

$dt = [T^1]$

$$e = \left[\frac{M^1L^2T^{-2}A^{-2}}{T^1}\right] \times [A^1]$$

$$= \left[\frac{M^1L^2T^{-2}A^{-1}}{T^1}\right]$$

$= [M^1L^2T^{-3}A^{-1}]$

41. (C)

42. (A)

$$\mu_0 = \frac{B \times r}{I}$$

$$\mu_0 = \frac{[M^1L^0T^{-2}A^{-1}][L^1]}{[A^1]}$$

$\mu_0 = [M^1L^1T^{-2}A^{-2}]$

43. (A)

Fractional error in the four measurements are respectively,

$$\pm\frac{0.1}{0.5}, \frac{\pm 0.01}{0.50}, \frac{\pm 0.001}{0.500}, \frac{\pm 0.0001}{0.5000}$$

This means the last measurement has the least error, i.e., it is the most accurate one. Hence, option (A) is correct.

44. (D)

$$n_2 = n_1\left(\frac{M_1}{M_2}\right)^1\left(\frac{L_1}{L_2}\right)^1\left(\frac{T_1}{T_2}\right)^{-2}$$

$$n_2 = 150\left(\frac{g}{kg}\right)^1\left(\frac{cm}{m}\right)^1\left(\frac{sec}{sec}\right)^{-2}$$

$$n_2 = 150\left(\frac{g}{10^3 g}\right)^1\left(\frac{cm}{10^2 cm}\right)^1\left(\frac{sec}{sec}\right)^{-2}$$

$$n_2 = \frac{150}{10^3 \times 10^2} = 1.5 \times 10^{-3}\ \text{N}$$

45. (C)

$$P = \frac{a^2b^2}{c^3\sqrt{d}}$$

$$\frac{\Delta P}{P} \times 100 = \left[2\left(\frac{\Delta a}{a}\right) + 2\left(\frac{\Delta b}{b}\right) + 3\left(\frac{\Delta c}{c}\right) + \frac{1}{2}\left(\frac{\Delta d}{d}\right)\right]$$

$$= \left[(2\times2) + (2\times3) + (3\times1) + (\frac{1}{2}\times2)\right] = 14\%$$

46. (A)

$\vec{r} = \vec{r_2} - \vec{r_1}$

$6\hat{i} - 9\hat{j} + \hat{k} = \vec{x} - (2\hat{i} + 4\hat{j})$

$\vec{x} = 8\hat{i} - 5\hat{j} + \hat{k}$

$|\vec{x}| = \sqrt{8^2 + 5^2 + 1^2} = 3\sqrt{10}$

47. (A)

Torque = force × displacement

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

48. (B)

$$\text{Average value} = \frac{150 + 151 + 152 + 149}{4} = 150.5\ \text{m/s}$$

Now,

$|\Delta v_1| = 150 - 150.5 = 0.5$

$|\Delta v_2| = 151 - 150.5 = 0.5$

$|\Delta v_3| = 152 - 150.5 = 1.5$

$|\Delta v_4| = 149 - 150.5 = 1.5$