APPENDIX A

ACHIEVEMENT TEST

Student Name: 

PRE – TEST/POST-TEST

Time: 1 hour 

Marks: 75 x 1 = 75

Note: Answer all the questions
Each question carries 1 mark

Knowledge type questions

1. The law that governs the force between electric charges is called
   (a) Ampere's law  (b) Coulomb's law  (c) Faraday's law  (d) Ohm's law

2. Which one of the following is the unit of electric charge
   (a) Coulomb  (b) Newton  (c) Volt  (d) Coulomb/Volt

3. Which one of the following is the unit of electric field intensity?
   (a) Volt X meter  (b) Volt/Joule  (c) Volt X joule  (d) Volt/meter

4. If an electron has an initial velocity in a direction different from that of an electric field, the path of the electron is
   (a) A straight line  (b) A circle  (c) An ellipse  (d) A parabola

5. Electric lines of force about a negative point charge are
   (a) Circular , anticlockwise  (b) Circular , clockwise
   © Radial , inward  (d) Radial , outward

6. An electric dipole of moment p is placed in the position of stable equilibrium in uniform electric field of intensity E. The couple required to rotate it through an angle \( \theta \) from the initial position is
   (a) pE\cos\theta  (b)pE \sin\theta  (c)pE \tan\theta  (d)-pE \cos\theta

7. The force experienced by a unit positive charge when placed in an electric field is called
   (a) Potential of electric field at that point(b) Moment of electric field at that point
   © Intensity of electric field at that point  (d) Capacity of electric field at that point

8. The intensity at a point due to a charge is inversely proportional to
   (a) Amount of charge  (b) Size of the charge © Distance of the point
   (d) Square of the distance from the charge

9. Check the correct relation
   (a) Potential = charge /capacity  (b) Charge = potential/capacity
   © Capacity = potential x charge  (d) Potential = capacity + charge

10. Static electricity is produced by
    (a) Friction only  (b) Induction only
    © Friction and induction  (d) Chemical reaction only
11. Which one of the following correctly represents lines of force surrounding two charged particles?

![Diagram of charged particles with lines of force]

12. Electric potential is a
   (a) Scalar quantity  b) Vector quantity  c)Dimensionless  d) Nothing can be said

13. An equipotential surface is that surface
   a) On which each and every point has the same potential
   b) Which has negative potential
   c) Which has positive potential
   d) Which has zero potential

14. Electric intensity and electric potential are related with each other by the relation
   a) \( V = \frac{dE}{dx} \)  b) \( E = \frac{dV}{dx} \)  c) \( E = \frac{dV}{dx} \)  d) \( E = \text{potential} \times \text{distance} \)

15. Farad is the unit of
   a) Self Inductance  b) Capacitance  c) Mutual Inductance  d) None of these

16. The energy of a charged conductor is given by
   a) \( q^2/2C \)  b)\( q^2/c \)  c) \( 2qC \)  d) \( q/2c^2 \)

**Understanding type questions**

17. Electric field due to a charge \( q \) at a distance \( r \) is
   (a) proportional to \( r^2 \)  (b) Inversely proportional to \( r^2 \)
   © Independent of \( r \)  (d) proportional to \( r \)

18. The force between two electrons separated by a distance \( r \) varies as
   (a) \( r^2 \)  (b) \( r \)  (c) \( r^1 \)  (d) \( r^2 \)

19. When the distance between two charged particles is halved, the force between them becomes
   (a) One fourth  (b) One-half  (c) Double  (d) Four times

20. The body can be negatively charged by
    (a) Giving excess of electrons to it  (b) Removing some electrons from it
    (c) Giving some protons to it  (d) Removing some neutrons from it
21. A hollow sphere of charge does not produce an electric field at any

(a) Interior point   (b) Outer point
© Beyond 2 meters  (d) Beyond 10 meters

22. Three charges 2q , -q , -q are located at the vertices of an equilateral triangle. At the centre of the triangle

(a) The field is zero but the potential is non-zero
(b) The field is non-zero but the potential is zero
© Both field and potential is zero
(d) Both field and potential are non-zero

23. An electric dipole is kept in a non-uniform electric field. It experiences

(a) A force and a torque   (b) A force but not a torque
© A torque but not a force   d) Neither a force nor a torque

24. Force between the protons in the nucleus is

(a) Only coulombian   (b)Only nuclear   (c)Both the above   (d) None of these

25 A large sphere P of radius R is charged positively. It is momentarily connected to a small sphere Q of radius r. The two spheres now have same

(a) Charge   (b) Electric field   (c) Energy   (d) Potential

26. Which of the following shows the variation of the electric field with radial distance for a conducting sphere having a uniform charge and a radius of a?

27. Which of the following shows the variation of the electrical potential with radial distance for a conducting sphere with a radius of a having a uniform charge?

28. Two charged spheres of radii 10cm and 15cm are connected by a wire. No current will flow if they have

a) The same charge on each   b) The same potential
 c) The same field on their surfaces   d) The same energy

29. Unit charge moves on an equipotential surface from a point A to point B then

a) \( V_A - V_B = +ve \)   b)\( V_A - V_B = 0 \)   c) \( V_A - V_B = -ve \)   d) It is stationary
30. Two conducting spheres of radii \( r_1 \) and \( r_2 \) are at the same potential. The ratio of their charges is
   a) \( r_1^2/r_2^2 \)  
   b) \( r_2^2/r_1^2 \)  
   c) \( r_1/r_2 \)  
   d) \( r_2/r_1 \)

31. The capacity of a conductor in the presence of dielectric medium
   a) Increases with dielectric medium  
   b) Decreases with dielectric medium  
   c) Is proportional to the square root of dielectric medium  
   d) Remains unchanged.

32. In order to increase the capacity of a parallel plate capacitor one should introduce between the plates a sheet of
   a) Mica  
   b) Tin  
   c) Copper  
   d) Stainless steel.

33. The capacity of a parallel plate capacitor is C. Its capacity when the separation between the plates is halved will be
   a) 4C  
   b)2C  
   c)C/2  
   d) C/4

34. On connecting the condensers in parallel having different capacitances, they will have the same
   a) Capacity  
   b) Potential difference  
   c) Charge density  
   d) Energy

**Application type questions**

35. If a glass rod is rubbed with silk , it acquires a positive charge because
   (a) Protons are added to it  
   (b) Protons are removed from it  
   (c) Electrons are added to it  
   (d) Electrons are removed from it

36. Two charges are placed at a distance apart. If a glass slab is placed between them, the force between will
   (a) Be zero  
   (b) Increase  
   (c) Decrease  
   (d) Remain the same

37. There are two charges +1 micro-coulomb and +5 micro coulomb. The ration of the forces acting on them will be
   (a) 1:5  
   (b) 1:1  
   (c) 5:1  
   (d) 1:25

38. \( F_g \) and \( F_e \) represents gravitational and electrostatic force respectively between electrons situated at a distance 10cm. The ratio of \( F_g/F_e \) is of the order of
   (a) \( 10^{42} \)  
   (b)10  
   (c)l  
   (d)\( 10^{-42} \)

39. A charge \( q_1 \) exerts some force on a second charge \( q_2 \). If a third charge \( q_3 \) is brought near, the force of \( q_1 \) exerted on \( q_2 \)
   (a) Decreases  
   (b) Increases  
   (c)Remains unchanged  
   (d) Increases if \( q_3 \) is of same sign as \( q_1 \) and decreases if \( q_3 \) is of opposite sign.

40. An electric field can deflect
   (a) X-rays  
   (b) Neutrons  
   (c) \( \alpha \) particles  
   (d) \( \gamma \) rays

41. There are two metallic spheres of same radii but once is solid and other is hollow then
(a) Solid sphere can be given more charge
(b) Hollow sphere can be given more charge
© They can be charge equally
(d) None of the above

42. Electric lines of force
   (a) are always parallel       (b) Never interest each other
   © are always perpendicular to each other  (d) Terminate at positive charges

43. With the rise in temperature, the dielectric constant $K$ of a liquid
   (a) Increases    (b) Decreases (c) remains unchanged    (d) changes erratically

44. If $E$ is the electric field intensity of an electrostatic field, than the electrostatic
   energy density is proportional to
   (a) $E$           (b) $E^2$          (c) $1/E^2$    (d) $E^3$

45. A uniform conducting sphere with a radius of $a$ and a uniform conducting
   spherical shell having an inner radius of $b$ and an outer radius of $c$ are placed as
   shown below. Electric field lines between the inner sphere and shell $(a<r<b)$ and
   outside the shell $(r>c)$ are radially outward. Which of the following concerning the
   charges of the sphere and shell is correct?

![Diagram of a sphere and a shell]

A) Charge of the sphere is $+Q$, charge of the shell is $-2Q$.
*B) Charge of the sphere is $+2Q$, charge of the shell is $-Q$.
C) The sphere is neutral, charge of the shell is $-Q$.
D) The sphere is neutral, charge of the shell is $+Q$.

46. Which of the following is definitely true when two uniformly charged conducting
   spheres one having a radius of $r$ and a charge of $+q$, the other one having a radius of
   $2r$ and having a charge of $+5q$ are connected by means of a conducting wire?

![Diagram of two connected spheres]

A) The spheres exchange charges until the charge of the spheres is equal.
*B) The spheres exchange charges until the potential of the spheres is equal.
C) Charge exchange between the spheres does not occur.
D) At the end of the charge exchange, total amount of the charge of the system is $+3q$. 

273
47. Equipotential potential surfaces for a uniform field of a particle having a net charge of +q are shown below. Which of the following needs maximum energy when a test charge moves along the paths given below?

A) From A to B        B) From C to D        *C) From D to E        D) From A to D

48. The capacitance of a parallel plate condenser does not depend upon
   a) area of the plates
   b) Medium between the plates
   c) Distance between the plates
   d) Metal of the plates

49. A and B are two spherical conductors of the same external size. A is solid and B is hollow. Both are charged to the same potential. If the charges on A and B are Q_A and Q_B respectively, then
   a) Q_A > Q_B       b) Q_A < Q_B       c) Q_A = Q_B       d) None of the above

50. The capacitor works in
   a) A.C. circuits     b) D.C. circuits     c) Both the circuits
   d) Neither in A.C. nor in D.C. circuits.

51. Can a metal be used as a medium for dielectric?
   a) Yes        b) No        c) Depends on its shape        d) Depends on dielectric

52. A capacitor of capacity C has charge Q and stored energy is W. If the charge is increased to 2Q, the stored energy will be
   a) 2W        b) W/2        c) 4W        d) W/4

53. The P.D of a solid and hollow sphere of same radii is equal, then under this condition
   a) The charge on solid sphere will be more
   b) The charge on hollow sphere will be more
   c) There will be equal charge on both
   d) The ratio of the charges on the two spheres is not constant

54. When the uncharged conductor is brought nearer to the charged conductor, then
   a) Its potential increases numerically
   b) Its potential decreases
   c) Its potential can be negative
d) Its charge charges

55. By inserting a plate of dielectric material between the plates of a parallel plate capacitor, the energy is increased five times. The dielectric constant of the material is
   a) 1/25    b) 1/5    c) 5    d) 25

56. You are traveling in a car during a thunder storm. In order to protect yourself from lighting, would you prefer to
   a) remain in a car
   b) Take shelter under a tree
   c) Get out and lie flat on the ground
   d) Touch the nearest electric pole

Skill type questions

57. An electron and a proton are at a distance of 1A. The moment of this dipole will be (cm)
   (a) 1.6 X 10^{-19} (b) 1.6 X 10^{-29} © 3.2 X 10^{-19} (d) 3.2 X 10^{-29}

58. The work done in carrying a charge of 5μC from a point A to B is 8mJ. The difference of potential between A and B is
   (a) 160V (b) 16V (c) 1.6kV (d)16kV

59. Two charges +4e and +e are at a distance x apart. At what distance, a charge q must be placed from charge +e so that it is in equilibrium ?
   (a) x/2 (b) 2x/3 (c) x/3 (d) x/6

60. A charge situated at a certain distance from an electric dipole in the end-on-position experiences a force F. If the distance of the charge is doubled, the force acting on the charge will be
   (a) 2F (b) F/2 (c) F/4 (d) F/8

61. The electric field inside a spherical shell of uniform surface density is
   (a) Zero (b) Constant less than zero © Directly proportional to the distance from the centre (d) none of these

62. A glass rod rubbed with silk acquires a charge of +8 X 10^{-12}C. The number of electrons it has gained or lost
   (a) 5 x 10^{-7} (gained) © 2 x 10^{-8} (lost) (b) 5x 10^{-7} (lost) (d) -8 x 10^{-12} (lost)

63. Electric field intensity is 400 Vm^{-1} at a distance of 2m from a point charge. It will be 100 Vm^{-1} at a distance
   (a) 50cm (b)4cm (c) 4m (d) 1.5m

64. The electrostatic force between two point charges kept at a distance d apart, in medium ε₆ = 6 is 0.3 N. The force between them at the same separation in vacuum is
   (a) 20N (b) 0.5 N (c)1.8 N (d) 2 N
65. Two different charges are placed on a horizontal line as shown below. Where the electrical potential energy of the system is zero?

![Diagram of two charges](image)

A) Only in part (I)  B) Only in part (II)  C) Only in part (III)  * E) In nowhere

66. Three capacitors of capacity 10μF, 5μF and 5μF are connected in parallel. The total capacity will be

a) 10μF  b) 5μF  c) 20μF  d) None of the above

67. The capacity of a parallel plate condenser is 5micro farad. When a glass plate is placed between the plates of the condenser, its potential becomes 1/8 of the original value. The value of dielectric constant will be

a) 1.6  b) 5  c) 8  d) 40

68. One plate of parallel plate capacitor is smaller than other, then charge on smaller plate will be

a) Less than other  b) More than other  c) Equal to other  d) Will depend upon the medium between them

69. A parallel plate condenser has a capacitance of 50μF in air and 110μF when immersed in an oil. The dielectric constant K of the oil is

a) 0.45  b) 0.55  c) 1.10  d) 2.20

70. A 10μF capacitor is charged to a voltage of 12volt. The stored energy is

a) 72x10^{-5} J  b) 12x10^{-5} J  c) 6x10^{-5} J  d) 3x10^{-5} J

71. A parallel plate capacitor is immersed in an oil of dielectric constant 2. The field between the plates is

a) Increased proportional to 2  b) Decreased proportional to 1/2  c) Increased proportional to √2  d) Decreased proportional to 1/√2

72. Three capacitors of capacitances 3μF, 9μF and 18μF are connected once in series and another time in parallel. The ratio of equivalent capacitance in the two cases (Cs/Cp) will be

a) 1:15  b) 15:1  c) 1:1  d) 1:3

73. If three capacitors each of capacity 1μF are connected in such a way that the resultant capacity is 1.5 μF, then

a) all the three are connected in series  b) all the three are connected in parallel  c) Two of them are in parallel and connected in series to the third  d) Two of them are in series and connected in parallel to the third.
74. The phenomenon of displacement of centers of positive and negative charges of non-polar direction in the presence of an electric field is called
a) Depolarisation  b) Electric susceptibility  c) Convection discharge
d) Dielectric polarization

75. In SI unit, the number of flux out coming are
a) 1/\varepsilon_0  b) 1/2\varepsilon_0  c) \varepsilon_0  d) \varepsilon_0/2
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Achievement test – Answer key

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APPENDIX B
Metacognitive Awareness inventory

<table>
<thead>
<tr>
<th></th>
<th>Metacognitive Awareness inventory</th>
<th>True</th>
<th>False</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I ask myself periodically if I am meeting my goals.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>I consider several alternatives to a problem before I answer.</td>
<td></td>
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<tr>
<td>3</td>
<td>I pace myself while learning in order to have enough time.</td>
<td></td>
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<tr>
<td>4</td>
<td>I understand my intellectual strengths and weaknesses.</td>
<td></td>
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<tr>
<td>5</td>
<td>I think about what I really need to learn before I begin a task</td>
<td></td>
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<tr>
<td>6</td>
<td>I know how well I did once I finish a test.</td>
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<tr>
<td>7</td>
<td>I set specific goals before I begin a task.</td>
<td></td>
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<tr>
<td>8</td>
<td>I slow down when I encounter important information.</td>
<td></td>
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<tr>
<td>9</td>
<td>I know what kind of information is most important to learn.</td>
<td></td>
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<tr>
<td>10</td>
<td>I ask myself if I have considered all options when solving a problem.</td>
<td></td>
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<tr>
<td>11</td>
<td>I am good at organizing information.</td>
<td></td>
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<tr>
<td>12</td>
<td>I consciously focus my attention on important information.</td>
<td></td>
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<tr>
<td>13</td>
<td>I learn best when I know something about the topic.</td>
<td></td>
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<tr>
<td>14</td>
<td>I know what the teacher expects me to learn.</td>
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<tr>
<td>15</td>
<td>I am good at remembering information.</td>
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<tr>
<td>16</td>
<td>I use different learning strategies depending on the situation.</td>
<td></td>
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<tr>
<td>17</td>
<td>I have control over how well I learn.</td>
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<tr>
<td>18</td>
<td>I periodically review to help me understand important relationships.</td>
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<tr>
<td>19</td>
<td>I ask myself questions about the material before I begin.</td>
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<tr>
<td>20</td>
<td>I think of several ways to solve a problem and choose the best one.</td>
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<tr>
<td>21</td>
<td>I summarize what I’ve learned after I finish.</td>
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<tr>
<td>22</td>
<td>I find myself analyzing the usefulness of strategies while I study.</td>
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<tr>
<td>23</td>
<td>I focus on the meaning and significance of new information.</td>
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<tr>
<td>24</td>
<td>I create my own examples to make information more meaningful.</td>
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<tr>
<td>25</td>
<td>I am a good judge of how well I understand something.</td>
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<tr>
<td>26</td>
<td>I find myself pausing regularly to check my comprehension.</td>
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<tr>
<td>27</td>
<td>I ask myself how well I accomplish my goals once I’m finished.</td>
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<tr>
<td>28</td>
<td>I draw pictures or diagrams to help me understand while learning.</td>
<td></td>
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<tr>
<td>29</td>
<td>I ask myself if I have considered all options after I solve a problem.</td>
<td></td>
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<tr>
<td>30</td>
<td>I try to translate new information into my own words.</td>
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<tr>
<td>31</td>
<td>I use the organizational structure of the text to help me learn.</td>
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<tr>
<td>32</td>
<td>I read instructions carefully before I begin a task.</td>
<td></td>
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<tr>
<td>33</td>
<td>I ask myself if what I’m reading is related to what I already know.</td>
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<tr>
<td>34</td>
<td>I reevaluate my assumptions when I get confused.</td>
<td></td>
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<tr>
<td>35</td>
<td>I organize my time to best accomplish my goals.</td>
<td></td>
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<tr>
<td>36</td>
<td>I learn more when I am interested in the topic.</td>
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<tr>
<td>37</td>
<td>I try to break studying down into smaller steps.</td>
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<tr>
<td>38</td>
<td>I focus on overall meaning rather than specifics.</td>
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<tr>
<td>39</td>
<td>I ask myself questions about how well I am doing while I am learning something new.</td>
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<tr>
<td>40</td>
<td>I stop and reread when I get confused.</td>
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</tbody>
</table>
## APPENDIX C
### Student attitude towards physics

<table>
<thead>
<tr>
<th>Student Name:</th>
</tr>
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</table>

<table>
<thead>
<tr>
<th></th>
<th>Attitude towards Physics learning</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>No opinion</th>
<th>Disagree</th>
<th>Strongly disagree</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>When I am solving a physics problem, I try to decide what would be a reasonable value for the answer</td>
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<td>2</td>
<td>A significant problem in learning physics is being able to memorize all the information I need to know</td>
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<tr>
<td>3</td>
<td>I think about the physics I experience in everyday life</td>
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<tr>
<td>4</td>
<td>It is useful for me to do lots and lots of problems when learning physics</td>
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<tr>
<td>5</td>
<td>After I study a topic in physics and feel that I understand it, I have difficulty solving problems on the same topic</td>
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<td>6</td>
<td>Knowledge in physics consists of many disconnected topics</td>
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<td>7</td>
<td>When I solve a physics problem, I locate an equation that uses the variables given in the problem and plug in the values</td>
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<td>8</td>
<td>I find that reading the text in detail is a good way for me to learn physics.</td>
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<tr>
<td>9</td>
<td>There is usually only one correct approach to solving a physics problem.</td>
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<tr>
<td>10</td>
<td>I am not satisfied until I understand why something works the way it does</td>
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<td>11</td>
<td>I cannot learn physics if the teacher does not explain things well in class</td>
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<tr>
<td>12</td>
<td>I do not expect physics equations to help my understanding of the ideas; they are just for doing calculations</td>
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<tr>
<td>13</td>
<td>I study physics to learn knowledge that will be useful in my life outside of school</td>
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<tr>
<td>14</td>
<td>If I get stuck on a physics problem my first try, I usually try to figure out a different way that works</td>
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<tr>
<td>15</td>
<td>Nearly everyone is capable of understanding physics if they work at it.</td>
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<td>16</td>
<td>Understanding physics basically means being able to recall something you've read or been shown.</td>
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<tr>
<td>17</td>
<td>There could be two different correct values to a</td>
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<tr>
<td>18</td>
<td>To understand physics I discuss it with friends and other students</td>
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<tr>
<td>19</td>
<td>I do not spend more than five minutes stuck on a physics problem before giving up or seeking help from someone else</td>
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<td>If I want to apply a method used for solving one physics problem to another problem, the problems must involve very similar situations.</td>
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<td>In doing a physics problem, if my calculation gives a result very different from what I'd expect, I'd trust the calculation rather than going back through the problem</td>
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<td>22</td>
<td>In physics, it is important for me to make sense out of formulas before I can use them correctly</td>
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<td>I enjoy solving physics problems.</td>
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<td>24</td>
<td>In physics, mathematical formulas express meaningful relationships among measurable quantities</td>
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<td>25</td>
<td>Learning physics changes my ideas about how the world works.</td>
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<td>26</td>
<td>To learn physics, I only need to memorize solutions to sample problems.</td>
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<tr>
<td>27</td>
<td>Reasoning skills used to understand physics can be helpful to me in my everyday life</td>
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<td>28</td>
<td>Spending a lot of time understanding where formulas come from is a waste of time</td>
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<td>29</td>
<td>I find carefully analyzing only a few problems in detail is a good way for me to learn physics</td>
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<tr>
<td>30</td>
<td>I can usually figure out a way to solve physics problems</td>
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<tr>
<td>31</td>
<td>The subject of physics has little relation to what I experience in the real world</td>
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<td>32</td>
<td>There are times I solve a physics problem more than one way to help my understanding</td>
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<td>33</td>
<td>To understand physics, I sometimes think about my personal experiences and relate them to the topic being analyzed</td>
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<td>It is possible to explain physics ideas without mathematical formulas.</td>
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<tr>
<td>35</td>
<td>When I solve a physics problem, I explicitly think about which physics ideas apply to the problem</td>
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<tr>
<td>36</td>
<td>If I get stuck on a physics problem, there is no chance I'll figure it out on my own</td>
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</tbody>
</table>
### APPENDIX D

**Home learning environment Inventory**

This questionnaire is meant to know your home learning facilities. Read the statements carefully and put the tick(√) mark in appropriate column.

<table>
<thead>
<tr>
<th></th>
<th>Home learning environment Inventory</th>
<th>Always</th>
<th>Sometimes</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Do you have a study table</td>
<td></td>
<td></td>
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<tr>
<td>2.</td>
<td>Do you have new paper at home</td>
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<tr>
<td>3.</td>
<td>Do you have English dictionary at home</td>
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<tr>
<td>4.</td>
<td>Do you have internet facility at home</td>
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<tr>
<td>5.</td>
<td>Do your elders at home help you to do your homework</td>
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<td></td>
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<tr>
<td>6.</td>
<td>Do your parents plan out your time-table</td>
<td></td>
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<td></td>
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<tr>
<td>7.</td>
<td>Do your parents check your note books well ahead and correct them</td>
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<tr>
<td>8.</td>
<td>Do your parents check whether you are punctual in your studies</td>
<td></td>
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<tr>
<td>9.</td>
<td>Do your parents encourage you to keep books and other articles neat and tidy</td>
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<tr>
<td>10</td>
<td>Do your parents create a favorable atmosphere at home for you to study</td>
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<tr>
<td>11</td>
<td>Do your parents check your physics book daily</td>
<td></td>
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<tr>
<td>No</td>
<td>Question</td>
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<td>--------------------------------------------------------------------------</td>
<td></td>
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<tr>
<td>12</td>
<td>Do your parents make sure that you do your problems in physics lesson</td>
<td></td>
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<tr>
<td>13</td>
<td>Do your parents help you to do your difficult physics projects</td>
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<tr>
<td>14</td>
<td>Do they advise you to clear your doubts in physics in the class itself</td>
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<tr>
<td>15</td>
<td>Do your parents encourage you to do more problems in connection with physics lessons?</td>
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<tr>
<td>16</td>
<td>Do your parents enquire your marks in physics</td>
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<tr>
<td>17</td>
<td>Do your parents try to compare your marks in physics with that of other subjects?</td>
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<tr>
<td>18</td>
<td>Do your parents advise to score full marks in physics</td>
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<tr>
<td>19</td>
<td>Do your parents contact your physics teacher</td>
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<td>20</td>
<td>Do they arrange special tution for you in physics</td>
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<tr>
<td>21</td>
<td>Do they advise you to study physics lessons by writing and not by mere reading</td>
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<tr>
<td>22</td>
<td>Do your parents buy you physics magazines?</td>
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<tr>
<td>23</td>
<td>Do your parents help you to prepare study materials in physics</td>
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<tr>
<td>24</td>
<td>Do your parents help you to make physics models</td>
<td></td>
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<tr>
<td>25</td>
<td>Do your parents bring you drawing sheets, pencils, instrument box etc?</td>
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<tr>
<td>26</td>
<td>Do your parents help you to draw circles, angles, triangles lines etc?</td>
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</tr>
<tr>
<td>27</td>
<td>Do your parents advise you to make company with talented students in physics?</td>
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<tr>
<td>28</td>
<td>Do your parents allow you to participate in combine study with neighboring students?</td>
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<td></td>
<td>Question</td>
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<tr>
<td>29</td>
<td>Do your parents encourage you to clarify your doubts from educated persons?</td>
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<td>30</td>
<td>Do they allow you to listen physics programmes through radio, TV, etc.</td>
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<tr>
<td>31</td>
<td>Do your parents encourage you to participate in physics quiz programmes conducted in your school?</td>
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<tr>
<td>32</td>
<td>Do you have a computer in your home?</td>
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<tr>
<td>33</td>
<td>Do your parents allow you to become a member of physics club in your school</td>
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<tr>
<td>34</td>
<td>Do your parents take you to physics fairs, conferences etc.</td>
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<tr>
<td>35</td>
<td>Do they allow you to participate in physics seminars?</td>
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<tr>
<td>36</td>
<td>Do your parents instruct you to keep paper cuttings of new mathematics inventions and events?</td>
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<tr>
<td>37</td>
<td>Do your parents bring to your notice new reports of physics inventions and events?</td>
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<tr>
<td>38</td>
<td>Do they discuss subject related to physics in your family</td>
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<tr>
<td>39</td>
<td>Do you get cooperation from your family in solving physics puzzles, problem riddles and jokes?</td>
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<tr>
<td>40</td>
<td>Do they tell you about life stories of eminent physicists?</td>
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</tbody>
</table>
## APPENDIX E

### Study habit inventory

<table>
<thead>
<tr>
<th>Study habit inventory</th>
<th>Always</th>
<th>Most often</th>
<th>Frequently</th>
<th>Sometimes</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I plan my work before I begin to study</td>
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<tr>
<td>2. I strictly observe my plan of study</td>
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<tr>
<td>3. I distribute my study periods among various subjects</td>
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<td>4. I study regularly throughout the year</td>
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<td>5. I work harder in the subject. I feel I am weak</td>
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<tr>
<td>6. I plan my study even for holidays</td>
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<td>7. I get headache when I begin to study</td>
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<tr>
<td>8. I cannot sit at a stretch and concentrate on my studies</td>
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<td>9. I take much time to get started to the task of study</td>
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<tr>
<td>10. I look for main ideas while reading a lesson</td>
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<td>11. I question the material as it is being read</td>
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<tr>
<td>12. I collect new words and phrases as I read a passage</td>
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<tr>
<td>13. I look up the meaning of an unfamiliar word in the dictionary</td>
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<td>14. While reading, I try to understand the authors viewpoint by relating it to my own experience</td>
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<tr>
<td>15. I relate material learnt in one subject to that learnt in others</td>
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<td></td>
<td></td>
<td>I day dream when I study</td>
<td>I understand and the lesson while reading it but I have trouble in remembering what I have read.</td>
<td>I find it difficult to decide what points are important in a lesson</td>
<td>I note down the points as I read a passage</td>
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<tr>
<td></td>
<td>I study even in the midst of distractions like radio, people talking, children play etc</td>
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<tr>
<td>36</td>
<td>I plan my answer before I start writing in the examinations</td>
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<tr>
<td>37</td>
<td>I revise my answers in the examination</td>
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<tr>
<td>38</td>
<td>I study hard only a few months before the examination</td>
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<tr>
<td>39</td>
<td>I have difficulty in expressing myself in writing</td>
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<tr>
<td>40</td>
<td>I get nervous during examination</td>
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</table>
APPENDIX F
STATISTICAL TOOLS

For analyzing the collected data, following statistical techniques were adopted

Mean

Mean = \frac{\sum X_i}{N}

Where

X_i = value of the i^{th} item
\Sigma = symbol for summation
N = Total number of items

Standard deviation

\sigma = \sqrt{\frac{N \sum X^2 - (\sum X)^2}{N}}

\Sigma = Summation
X = Any raw score
N = Number of cases

t - test

\[
t = \frac{M_1 - M_2}{\sqrt{\frac{\sigma_1^2}{N_1} + \frac{\sigma_2^2}{N_2}}}
\]
Where

\[ M_1 = \text{Mean of the first group} \]
\[ M_2 = \text{Mean of the second group} \]
\[ \sigma_1 = \text{Variance of the first group} \]
\[ \sigma_2 = \text{Variance of the second group} \]

**Pearson's product moment correlation**

\[
\gamma = \frac{N \sum XY - (\sum X)(\sum Y)}{\sqrt{\left[N \left(\sum X^2\right) - (\sum X)^2\right] - \left[N \left(\sum Y^2\right) - (\sum Y)^2\right]}}
\]

where

\[ N = \text{Total number of pairs} \]
\[ X,Y = \text{Row scores and} \]
\[ \gamma = \text{Pearson's product moment correlation co-efficient} \]

**Chi-Square Test**

To find out the association between variables, the chi-square test has been used.

\[
\chi^2 = \frac{\sum (O - E)^2}{E}
\]

Where

\[ O = \text{Observed Frequency} \]
E = Expected Frequency

ANOVA

Analysis of variance has been used to find out the difference among the groups
Mean Square Variance between groups
\[ F = \frac{\text{Mean Square Variance between groups}}{\text{Mean Square Variance within groups}} \]

Paired 't' test

It is used to analyse the results of a 'before' and 'after' the experiment.

\[ t = \frac{\bar{D} - 0}{\frac{\sigma_{\text{diff}}}{\sqrt{n}}} \]

\( \bar{D} \) - Mean of differences.

If the values from paired samples are denoted as \( X_i \) and \( Y_i \) and differences by \( D_i \) (\( D_i = X_i - Y_i \)) then the mean of differences i.e.,

\[ \bar{D} = \frac{\sum D_i}{n} \]

\[ (\sigma_{\text{diff}})^2 = \frac{\sum D_i^2 - (\bar{D})^2 \cdot n}{n-1} \]

\( \sigma_{\text{diff}} \) - Standard deviation of the differences

\( n \) – number of matched pairs

Omega Square

Omega Square is an index of the degree to which one variable accounts for another variable. It is a statistical index of the degree to which the independent variable accounts for variance in the dependent variable.
Omega Square \[ \omega^2 = \frac{t^2 - 1}{t^2 + N_1 + N_2 - 1} \]

Where \( N_1 \) = Number of students in pre-test
\( N_2 \) = Number of students in post-test
\( t \) = t value in paired t test.

Effect Size: Cohn's d from t test

This is a statistic that indicates the relative magnitude of the difference between two means.

Effect size \[ d = \frac{M_1 - M_2}{S.D_{\text{Common}}} \]

\[ S.D_{\text{Common}} = \sqrt{ \frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{n_1 + n_2} } \]

d = Effect size index for the t ratio of the difference between means
\( M_1 \) = Mean of the pre-test
\( M_2 \) = Mean of the post-test
\( n_1 \) = Number of students in the pre-test
\( n_2 \) = Number of students in the post-test
\( S_1 \) = Standard deviation of the pre-test
\( S_2 \) = Standard deviation of the post-test

Relative Size of Cohen's d

negligible effect \( (\geq -0.15 \text{ and } < 0.15) \)
small effect \( (\geq 0.15 \text{ and } < 0.40) \)
medium effect \( (\geq 0.40 \text{ and } < 0.75) \)
large effect \( (\geq 0.75 \text{ and } < 1.10) \)
very large effect \( (\geq 1.10 \text{ and } < 1.45) \)
huge effect \( > 1.45 \)