Chapter 1 – Lesson 1 (Work)

Choose the Correct Answer

1. Work is considered ……
   a) Scalar and measured by newton
   b) Scalar and measured by Joule
   c) Vector and measured by newton
   d) Vector and measured by Joule

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2. The dimensional formula of work is ……
   a) ML^2T^{-2} b) MLT^{-2} c) MLT d) MLT^{-1}

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3. The unit **Joule** is equivalent to:
   a) N/m b) N.m c) $kg{\cdot}m^2/s^2$ d) Both (b) and (c)

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4. The work done by a force acting at an angle θ with the displacement is given by:
   a) F·d b) F·d·sinθ c) F·d·cosθ d) F·cosθ

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5. The work done by a force is **zero** when the angle between the force and the displacement is:
   a) 0° b) 60° c) 45° d) 90°

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6. The work is negative when the direction of displacement is …… the direction of the force.
   a) In the same
   b) Opposite
   c) Perpendicular to
   d) no correct answer

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7. When the force acts on a body and the angle between the force and the displacement is **60°**, the work done is:
   a) Maximum b) Half of maximum c) Zero d) Negative

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8. If the applied force acting on a body is doubled while the distance moved remains the same, the work done ……
   a) Doubles b) Increases to four times c) Decreases to half d) no correct answer

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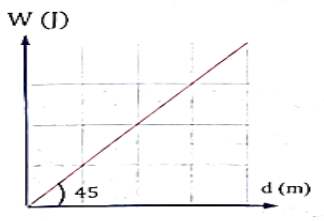
9. The graph shows the relation between work and displacement when a force acts at an angle of **60°**. If the acceleration is **4 m/s²**, the mass of the body is:



a) 0.2 kg
b) 0.4 kg
c) 0.5 kg
d) 0.6 kg

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10. A man carries a bag of mass 5 kg and climbs a staircase of length 10 m that is inclined at an angle of 30° to the horizontal. The work done on the bag while climbing the stairs is: ($g = 10\ m/s^2$)

a) 500 J
b) 433 J
c) 250 J
d) Zero

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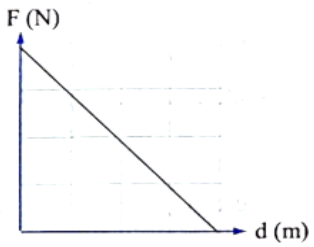
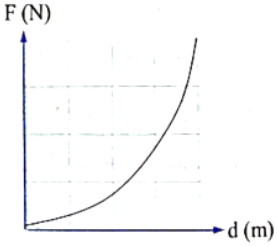
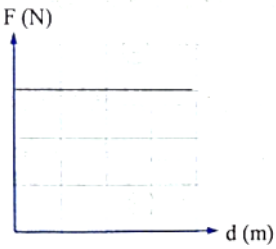
11. The following graphs show the relationship between the force (F) acting on a group of moving bodies and the displacement (d).
If all bodies move in the same direction as the applied force, which of these bodies has the greatest work done on it?



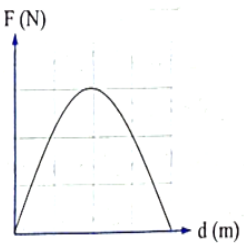
a) A



b) B



c) C



d) D

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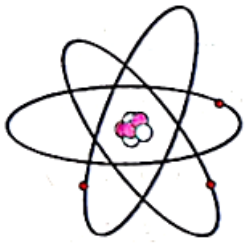
12. The work done by an electron moving in a circular path is:



a) Zero
b) Maximum in Level one
c) Maximum in Last level
d) Equal in all Levels

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13. A body moves in a circular path of radius **20 m**. If a force of **50 N** acts perpendicular to the direction of motion, the work done is:
    a) Zero b) 150 J c) 200 J d) 240 J

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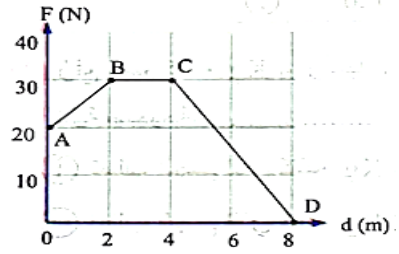
14. The graph shows the relation between force and displacement. The work done over a distance of **8 m** equals:
    a) Zero
    b) 100 J
    c) 130 J
    d) 170 J



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15. A horse pulls a load using a rope along a road where rope inclined on road with angle 60° for a distance of 200 m. If the mass of the load is 150 kg and the acceleration of motion is 2 m/s², the work done by the horse is ……
    a) Zero
    b) 30000 J
    c) 1500 J
    d) 60000 J

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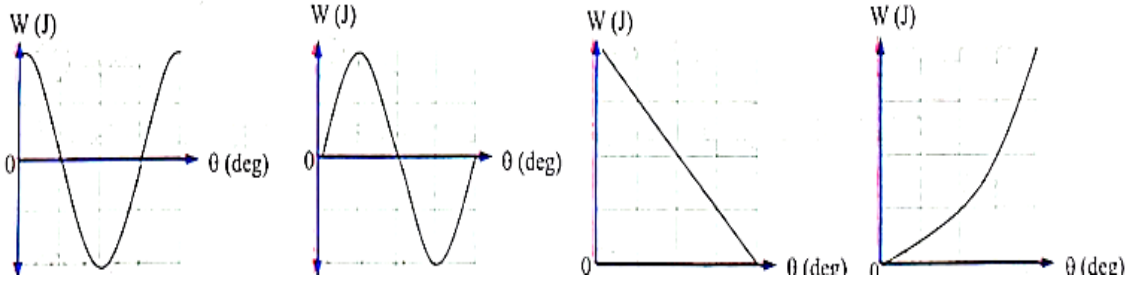
16. The graph that represents the relationship between the work done and the angle between the direction of the force and the displacement is ……



a) A b) B c) C d) D

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17. An elevator carries a person of mass 80 kg to a height of 100 m. The work done on this person is: …… ($g = 9.8$ m/s²)
    a) Zero b) 8000J c) 78400 J d) 89000 J

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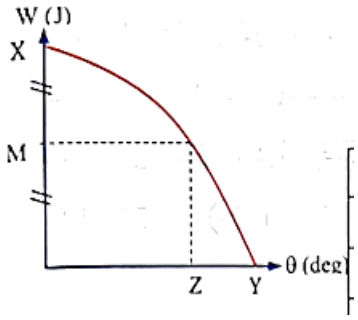
18. The adjacent graph represents the relationship between the work done on a body and the angle between the force acting on the body and the displacement resulting from this force. Choose the correct values of (X, Y, M, Z), in order.

	Z	M	Y	X
a)	30°	$\frac{\sqrt{3}}{2}$ F·d	60°	$\frac{1}{2}$ F·d
b)	60°	$\frac{1}{2}$ F·d	90°	F·d
c)	90°	0	30°	F·d
d)	60°	F·d	60°	$\frac{1}{2}$ F·d



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19. A body of mass 4 kg is lifted vertically through a distance of 3 m, and another body of mass 2 kg is lifted vertically through a distance of 6 m.
Which of the following statements is correct?
a) The body of mass 4 kg requires more work to lift because its mass is larger.
b) The body of mass 2 kg requires more work to lift because it is raised to a greater height.
c) Both bodies require the same amount of work to lift.
d) The required work cannot be compared because time information is not given.

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20. A body of mass 5 kg is lifted to a height of 8 m in a vertical direction. ($g = 10\ m/s^2$)
The work done is:
a) 1.7 J b) 45 J c) 1.5×10^3 J d) 4×10^2 J

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21. A force of 25 N is used to pull a bag, and the work done is 50 J.
What distance does the bag move?
a) 2 m b) 1 m c) 3 m d) 4 m

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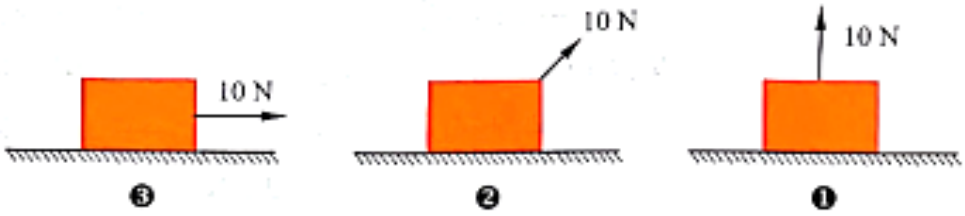
22. If a box is pulled on a smooth horizontal surface by a force of 10 N, arrange the following situations according to the work done on the box, from the smallest to the largest.



a) 1>2>3 b) 3>2>1 c) 2>3>1 d) 1>3>2

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23. A body of mass 2 kg moves with a speed of 3 m/s affected by force of 4 N acts in the direction of motion then removed after the body moves a distance of 5 m, then the work done on the body is:
    a) 0 J
    b) 20 J
    c) 60 J
    d) 120 J

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24. A box of weight 80 N slides with constant speed for a distance of 5 m along an inclined plane that makes an angle of 30° with the horizontal.
    The work done by the force of gravity is equal to:
    a) 0 J b) 200 J
    c) 400 J d) 1600 J

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25. The force of friction does …… work.
    a) Zero
    b) Positive
    c) Negative
    d) No correct answer

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26. A satellite does not consume fuel while moving in its circular orbit which no work on it because the force acting on it is:
    a) Perpendicular to the direction of its motion
    b) Opposite to the direction of its motion
    c) In the same direction of its motion
    d) Equal to zero

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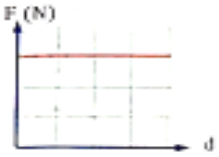
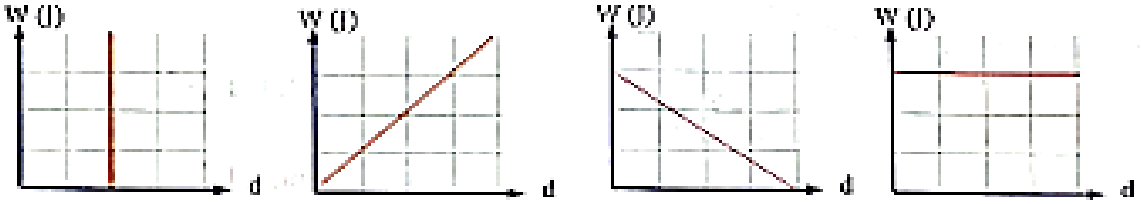
27. The figure shows the relationship between the force acting on a body and the displacement. The graph that represents the relationship between the work done and the displacement is:





a) A b) B c) C d) D

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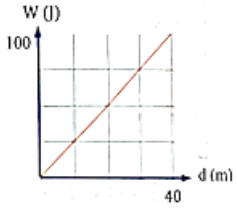
28. The graph shows the relationship between work and displacement when the force acts at an angle. If the angle between the displacement and the force is **60°**, then the magnitude of the force equals:



a) 5 N b) 10 N c) 15 N d) 2.5 N

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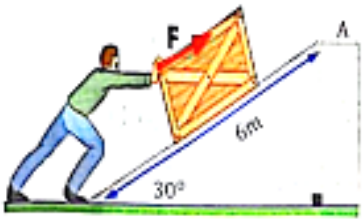
29. In the figure, a force of **50 N** is used to push a box up a smooth inclined plane of length **6 m** that makes an angle of **30°** with the horizontal. (g = 10 m/s²)



The work done on the box when it reaches point **A** is equal to:

a) 300 J b) 150 J c) 3000 J d) 1500 J

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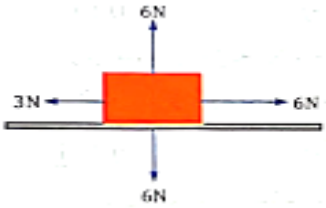
30. The figure shows four forces acting on a body resting on a smooth horizontal surface. If these forces cause the body to move **1 m**, the net work done by the resultant force is:

a) 2 J
b) 3 J
c) 9 J
d) 6 J



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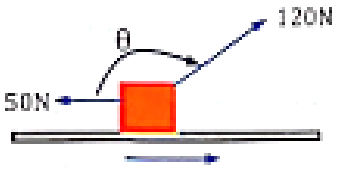
31. A body is acted upon by two forces on a smooth horizontal surface as shown in the figure. If the work done by the resultant force over a distance of **60 m** is **600 J**, then the angle **(θ)** equals:

a) 100°
b) 160°
c) 150°
d) 120°



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32. In the adjacent figure, the arrow shows the direction of the force used by a person to lift a box. Therefore, the person ……

a) Does work on the box, because the force acting on the box is less than the force of gravity.

b) Does work on the box, because the force acting on the box is in the same direction as the displacement.

c) Does not do work on the box, because the displacement of the box is opposite to the direction of gravity.

d) Does not do work on the box, because the force acting on the box is perpendicular to the direction of its displacement.

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33. A person pulls a box with a force **(F)** through a distance **(d)** in a direction that makes an angle of **30°** with the direction of the applied force, as shown in the figure.

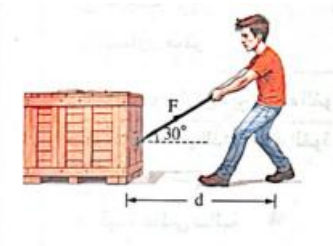
The work done on the box by this person is equal to:

a) Zero

b) $\frac{1}{2}$ F d

c) $\sqrt{3/2}$ F d

d) F d



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34. Which of the following forces does **work** on the body on which it acts?

a) The force of gravity acting on a train moving on a straight horizontal track.

b) The force exerted by a person pushing a large tree.

c) The frictional force between the tires of a car and the road when the brakes are applied.

d) All of the previous forces.

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35. A motorcycle moves in a straight line under the action of a driving force of **500 N** and a frictional force of **200 N**. The work done by the resultant force on the motorcycle when it moves a distance of **50 m** is equal to:

a) 15×10^3 J b) 25×10^3 J

c) 20×10^3 J d) 35×10^3 J

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36. A girl walks along a straight horizontal path for a distance of **6 m** while carrying a bag of weight **10 N**, then she climbs a staircase to reach a height of **8 m**. The total work done by the girl on the bag is equal to:

a) 60 J b) 80 J c) 100 J d) 140 J

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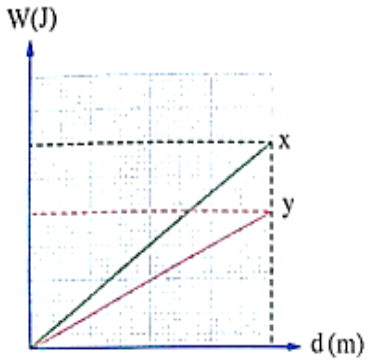
37. Two bodies **(X)** and **(Y)** have the same mass and are placed on a horizontal surface. Each body is acted upon by a constant force; the magnitudes of the forces are $\mathbf{F_x}$ and $\mathbf{F_\gamma}$, respectively. The adjacent graph represents the relationship between the work done **(W)** by the applied force and the displacement **(d)** for each body. The ratio between the magnitudes of the two forces $\left(\frac{F_x}{F_y}\right)$ is equal to:



a) $^1/_2$
b) $^3/_2$
c) 3
d) 2

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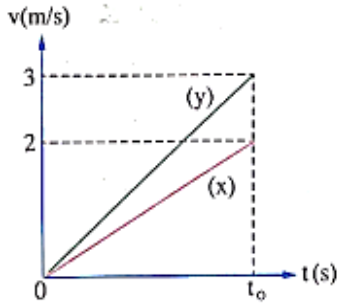
38. Two bodies **(X)** and **(Y)** have the same mass and start moving from rest on a smooth horizontal surface under the action of different resultant horizontal forces.
The adjacent graph represents the relationship between the velocity **(v)** and time **(t)** for each body. Find the ratio between the amounts of work done on the two bodies by the resultant force $\left(\frac{W_x}{W_y}\right)$

(1) When both bodies cover the same displacement, the ratio is equal to:
a) 2⁄3
b) 3⁄2
c) 4⁄9
d) 9⁄4

(2) During the time interval from **0** to $\mathbf{t_o}$, the ratio is equal to:
a) 2⁄3
b) 3⁄2
c) 4⁄9
d) 9⁄4



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39. Three boxes (A), (B), and (C) are placed on a horizontal surface.
Each box is pulled by the same horizontal force (F_0). The boxes move through displacements **d_0, d_0, and $2d_0$** respectively, during time intervals **t_0, $2t_0$, and $4t_0$** respectively. The correct order of the work done on the boxes by the force (F_0) is:

a) A = B = C b) A < B = C c) A = B < C d) B < A < C

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40. In the adjacent figure, a crane lifts a load of mass **0.5 ton** vertically upward from the ground to a height of **10 m** at a constant speed.
Given that the acceleration due to gravity is **10 m/s²**, find the work done by:

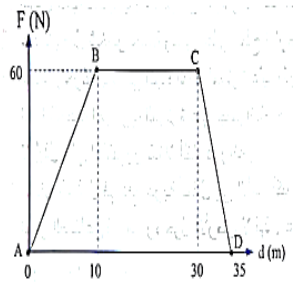
1) The work of tension force in the rope on the load is equal to:
a) 0 J
b) 50 J
c) −50 kJ
d) 50 kJ

2) The work of gravity force acting on the load is equal to:
a) 0 J
b) 50 J
c) −50 kJ
d) 50 kJ

3) The work of resultant force acting on the load is equal to:
a) 0 J
b) 50 J
c) −50 kJ
d) 50 kJ

Essay Questions

41. A horizontal force acts on a body, and its magnitude changes with the displacement as shown in the graph.Calculate the work done by the force in moving the body from zero displacement to a displacement of **35 m**.



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42. When we push a wall with a force of **100 N**, do we do any physical work? Why?

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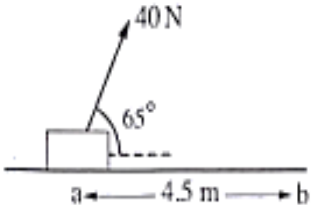
43. The adjacent figure shows a body placed on a horizontal surface. A force of **40 N** acts on it, making an angle of **65°** with the horizontal. If the body moves a distance of **4.5 m** from point **a** to point **b**, and the force of friction is equal to **15 N** , calculate the work done on the body by the resultant force.



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