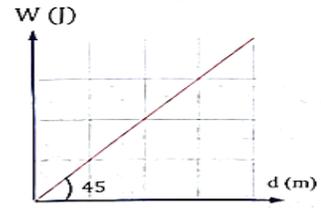


Chapter 1 – Lesson 1 (Work)Choose the Correct Answer

-
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
-
2. The dimensional formula of work is
- a) ML^2T^{-2} b) MLT^{-2} c) MLT d) MLT^{-1}
-
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)
-
4. The work done by a force acting at an angle θ with the displacement is given by:
- a) $F \cdot d$ b) $F \cdot d \cdot \sin\theta$ c) $F \cdot d \cdot \cos\theta$ d) $F \cdot \cos\theta$
-
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°
-
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
-
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
-
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
-

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/s^2 , the mass of the body is:

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



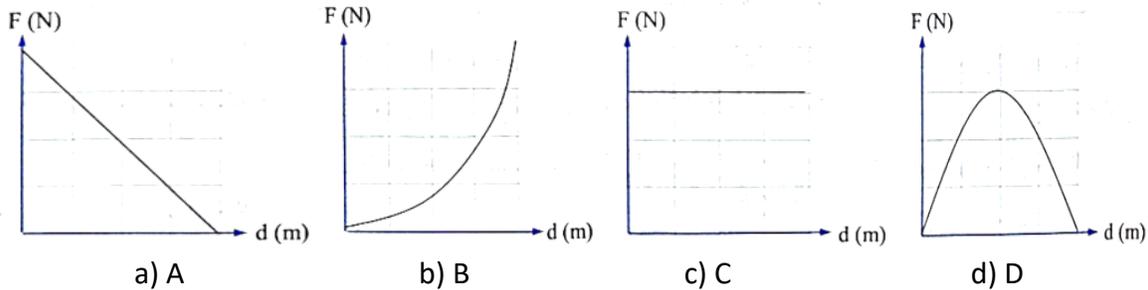
10. A man carries a bag of mass 5 kg and climbs a staircase of length 10 m that is inclined at an angle of 30° to the horizontal. The work done on the bag while climbing the stairs is: ($g = 10 \text{ m/s}^2$)

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



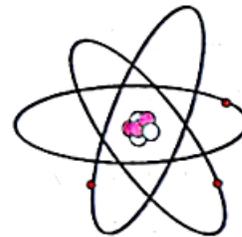
11. The following graphs show the relationship between the force (F) acting on a group of moving bodies and the displacement (d).

If all bodies move in the same direction as the applied force, which of these bodies has the greatest work done on it?



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

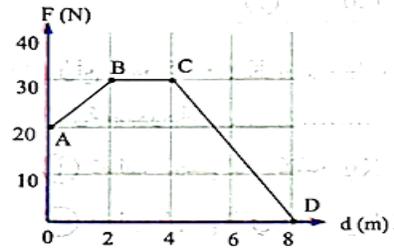


13. A body moves in a circular path of radius **20 m**. If a force of **50 N** acts perpendicular to the direction of motion, the work done is:

- a) Zero b) 150 J c) 200 J d) 240 J

14. The graph shows the relation between force and displacement. The work done over a distance of **8 m** equals:

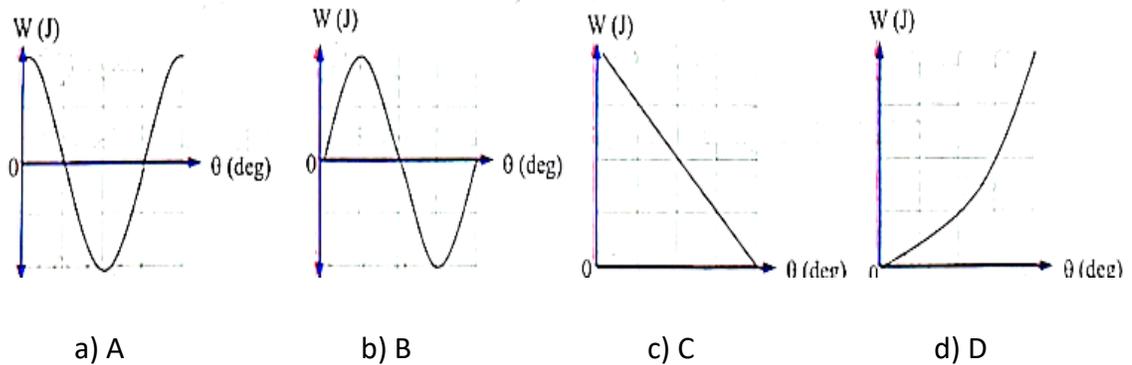
- a) Zero
b) 100 J
c) 130 J
d) 170 J



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/s^2 , the work done by the horse is

- a) Zero
b) 30000 J
c) 1500 J
d) 60000 J

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

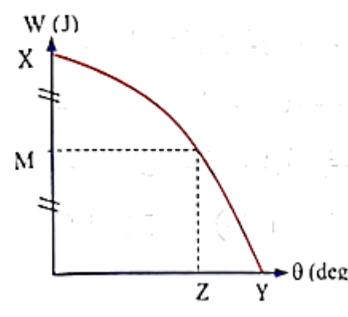
d) D

17. An elevator carries a person of mass 80 kg to a height of 100 m. The work done on this person is: ($g = 9.8 \text{ m/s}^2$)

- a) Zero b) 8000J c) 78400 J d) 89000 J

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°	$\frac{\sqrt{3}}{2} F \cdot d$	60°	$\frac{1}{2} F \cdot d$
b)	60°	$\frac{1}{2} F \cdot d$	90°	$F \cdot d$
c)	90°	0	30°	$F \cdot d$
d)	60°	$F \cdot d$	60°	$\frac{1}{2} F \cdot d$



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?
- The body of mass 4 kg requires more work to lift because its mass is larger.
 - The body of mass 2 kg requires more work to lift because it is raised to a greater height.
 - Both bodies require the same amount of work to lift.
 - The required work cannot be compared because time information is not given.

20. A body of mass 5 kg is lifted to a height of 8 m in a vertical direction. ($g = 10 \text{ m/s}^2$)

The work done is:

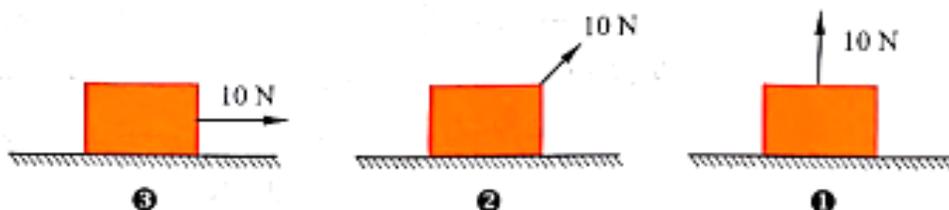
- 1.7 J
- 45 J
- $1.5 \times 10^3 \text{ J}$
- $4 \times 10^2 \text{ J}$

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?

- 2 m
- 1 m
- 3 m
- 4 m

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.



- $1 > 2 > 3$
- $3 > 2 > 1$
- $2 > 3 > 1$
- $1 > 3 > 2$

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

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

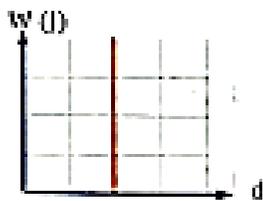
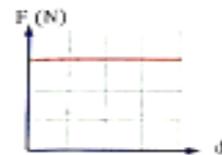
25. The force of friction does work.

- a) Zero
- b) Positive
- c) Negative
- d) No correct answer

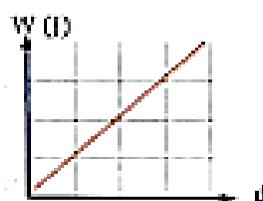
26. A satellite does not consume fuel while moving in its circular orbit which no work on it because the force acting on it is:

- 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

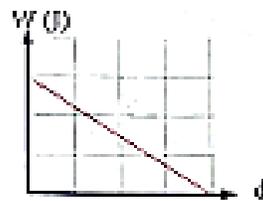
27. The figure shows the relationship between the force acting on a body and the displacement. The graph that represents the relationship between the work done and the displacement is:



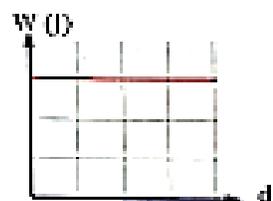
a) A



b) B

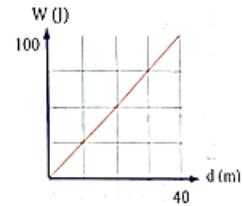


c) C



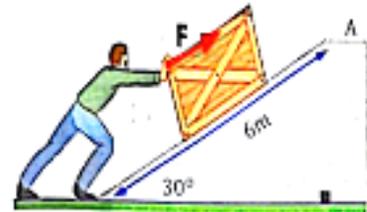
d) D

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

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. ($g = 10\text{ m/s}^2$)

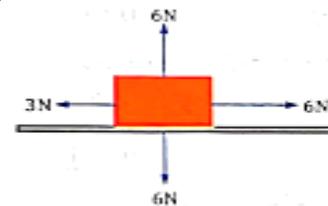


The work done on the box when it reaches point A is equal to:

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

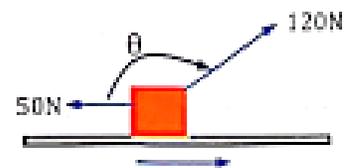
30. The figure shows four forces acting on a body resting on a smooth horizontal surface. If these forces cause the body to move 1 m , the net work done by the resultant force is:

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



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°



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

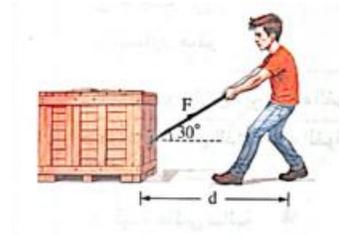
- a) Does work on the box, because the force acting on the box is less than the force of gravity.
- b) Does work on the box, because the force acting on the box is in the same direction as the displacement.
- c) Does not do work on the box, because the displacement of the box is opposite to the direction 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.



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) $F d$



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.

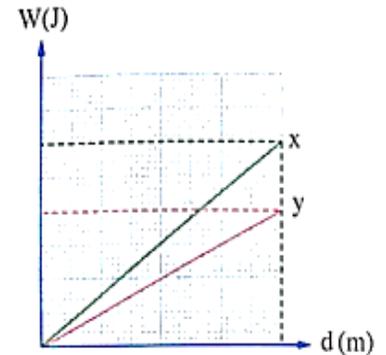
35. A motorcycle moves in a straight line under the action of a driving force of **500 N** and a frictional force of **200 N**. The work done by the resultant force on the motorcycle when it moves a distance of **50 m** is equal to:

- a) $15 \times 10^3 \text{ J}$
- b) $25 \times 10^3 \text{ J}$
- c) $20 \times 10^3 \text{ J}$
- d) $35 \times 10^3 \text{ J}$

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:

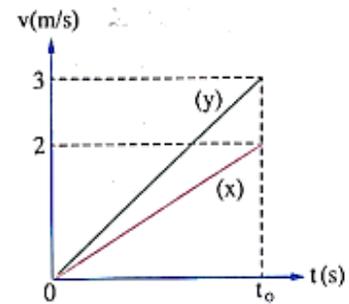
- a) 60 J
- b) 80 J
- c) 100 J
- d) 140 J

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 F_x and F_y , 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

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 t_0 , the ratio is equal to:

- a) $2/3$
- b) $3/2$
- c) $4/9$
- d) $9/4$

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) $B < A < C$
-

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**.

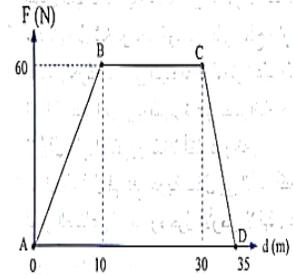
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42. When we push a wall with a force of **100 N**, do we do any physical work? Why?

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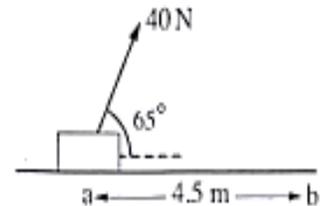
43. The adjacent figure shows a body placed on a horizontal surface. A force of **40 N** acts on it, making an angle of **65°** with the horizontal. If the body moves a distance of **4.5 m** from point **a** to point **b**, and the force of friction is equal to **15 N**, calculate the work done on the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

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Chapter 1 – Lesson 2 (Energy)

Choose the correct answer:

1 - Kinetic energy

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

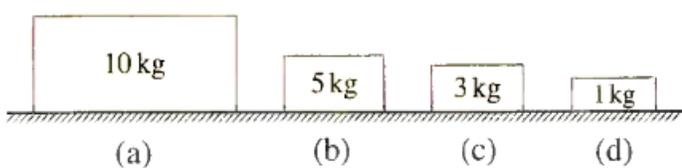
2. A car of mass **2000 kg** moves with a speed of **60 km/h**.
 The kinetic energy of the car is:
 a) 1.7×10^4 J b) 6×10^4 J c) 2.78×10^5 J d) 3.6×10^5 J

3. When the speed of a car is doubled, the kinetic energy
 a) Decreases to half b) Doubles c) Increases to four times d) Remains constant

4. The kinetic energy of a body is equal to the square of its speed when the mass of the body is:
 a) 2 kg b) 4 kg c) 6 kg d) 10 kg

5. The slope of the graph between the square of the speed on the vertical axis and the reciprocal of the mass on the horizontal axis is equal to:
 a) $\frac{1}{2}$ K.E b) K.E c) 2 K.E d) $\sqrt{K.E}$

6. In the adjacent figure, there are four bodies **(a), (b), (c), and (d)** of different masses moving with constant speed.



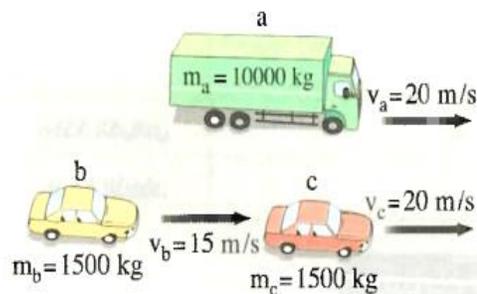
(1) If all four bodies have the same speed, then the body that has the **greatest kinetic energy** is:

- a) (a) b) (b) c) (c) d) (d)

(2) If all four bodies have the same kinetic energy, then the body that has the **greatest speed** is:

- a) (a) b) (b) c) (c) d) (d)

7. Choose the correct order of the cars shown in the figure according to the kinetic energy of each.



- a) $b < c < a$
 b) $c < b < a$
 c) $b > c > a$
 d) $c = b = a$

8. A boy of mass **72 kg** has a kinetic energy equal to that of a car of mass **1200 kg** moving at a speed of **9 km/h**.

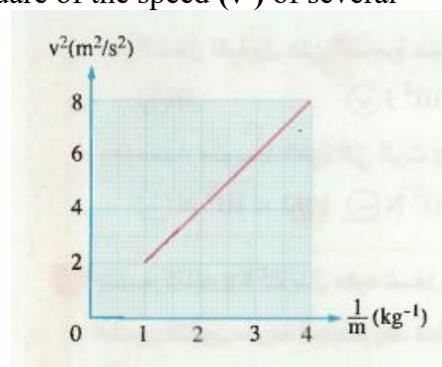
The speed of the boy is:

- a) 2.27 m/s b) 3.04 m/s c) 5.14 m/s d) 10.21 m/s

9. The adjacent graph shows the relationship between the square of the speed (v^2) of several bodies and the reciprocal of the mass ($1/m$) for each body, where all bodies have the same kinetic energy.

The kinetic energy of each body is equal to:

- a) 0.5 J
 b) 1 J
 c) 2 J
 d) 4 J



10. A body has a kinetic energy of **4 J**. If its speed is doubled, its kinetic energy becomes:

- a) 0.8 J b) 4 J c) 8 J d) 16 J

11. If the mass of the first body is double the mass of the second body, and the speed of the first body is half the speed of the second body, then the kinetic energy of the first body is the kinetic energy of the second body.

- a) Half b) Double c) One quarter d) Four times

12. The slope of the graph between the kinetic energy on the vertical axis and the reciprocal of the mass on the horizontal axis is equal to: (P is referring to momentum)

- a) $\frac{1}{2} P^2$ b) P^2 c) $2P$ d) \sqrt{P}

13. The momentum can be calculated from the relation:

- a) $\frac{K.E}{v}$ b) $\frac{2 K.E}{v}$ c) $\frac{K.E}{2v}$ d) $\frac{K.E}{v^2}$

14. Two bodies X and Y have the same kinetic energy. If the mass of body X is **four times** the mass of body Y, then the ratio of $\frac{P_x}{P_y}$ is equal to:

- a) 1/2 b) 2/1 c) 1/4 d) 4/1

15. If the kinetic energy of a body is **twice its momentum**, then the speed of the body is

- a) 1 m/s b) 2 m/s c) 4 m/s d) 8 m/s

16. A car moves in a straight line. If its momentum increases to **three times** its original value, then its kinetic energy

- a) Doubles
b) Increases to three times
c) Increases to nine times
d) Remains constant

17. A person pushes a cart carrying boxes. The following forces act on the cart:

- (I) The pushing force exerted by the person
(II) The force of friction
(III) The force of gravity (weight)
(IV) The normal reaction force exerted by the ground

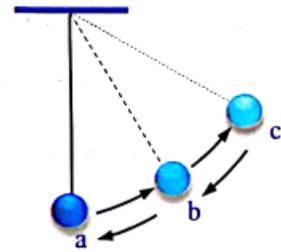
Which pair of these forces don't **work** on the cart when it moves through a displacement (**d**)?

- a) Forces (I) and (II) b) Forces (III) and (IV)
c) Forces (II) and (III) d) Forces (I) and (IV)

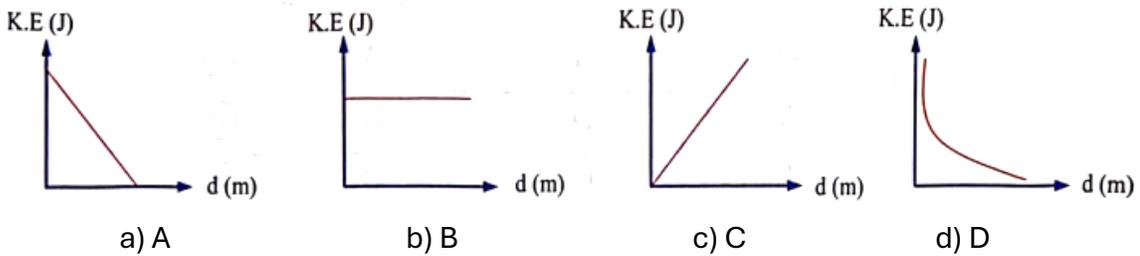


18. In the adjacent figure, the **maximum kinetic energy** of the pendulum is at position

- a) a
- b) b
- c) c
- d) **All of the above**

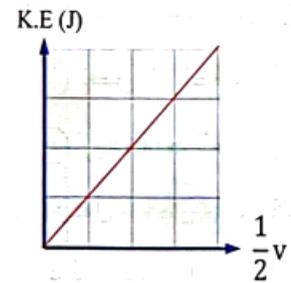


19. The graph shows the change in the kinetic energy (**K.E.**) of a body falling freely with its distance (**d**) changes is:



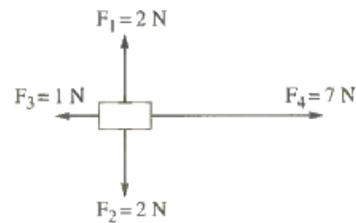
20. The slope of the straight line in the adjacent graph represents the of the body.

- a) Mass of the body
- b) Weight of the body
- c) Momentum of the body
- d) Speed of the body

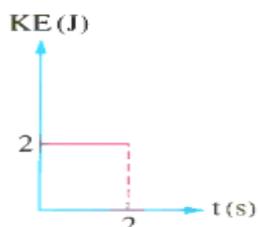
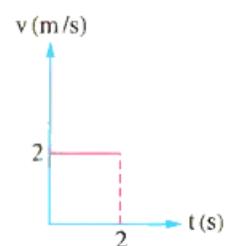


21. The figure shows the directions and magnitudes of four horizontal forces acting on a body placed on a horizontal surface. If the body moves 4 m, the change in its kinetic energy is equal to:

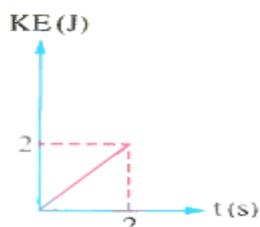
- a) 8 J
- b) 10 J
- c) 24 J
- d) 32 J



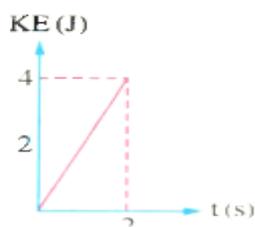
22. The adjacent graph represents the relationship between the speed (**v**) of a body of mass **2 kg** and the time (**t**) of its motion.
Which of the following graphs represents the relationship between the kinetic energy (**KE**) of the body and time (**t**)?



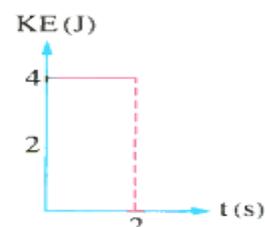
a) A



b) B



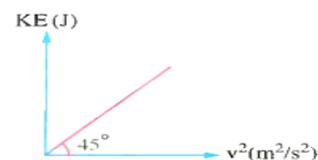
c) C



d) D

23. The adjacent graph represents the relationship between the kinetic energy (**KE**) of a body and the square of its speed (**v²**). If the two quantities are represented on both axes using the same scale, then the mass of the body is equal to:

- a) 0.5 kg
b) 1 kg
c) 2 kg
d) 5 kg



24. A car of mass 3×10^3 kg is moving with a speed of 16 m/s when it collides with a tree and comes to rest, as shown in the figure.

(1) The change in the kinetic energy of the car is equal to:

- a) -3.84×10^5 J b) -2.4×10^4 J
c) 2.4×10^4 J d) 3.84×10^5 J

(2) The work done on the tree when the front of the car collides with it is equal to:

- a) 0 J b) 2.4×10^4 J c) 3.84×10^5 J d) 6.23×10^5 J

(3) The average force exerted on the front of the car if it is compressed by 50 cm is equal to:

- a) 1.92×10^5 N b) 5.76×10^5 N c) 7.68×10^5 N d) 9.6×10^5 N

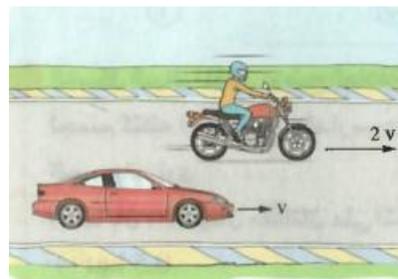


25. The adjacent figure shows a car of mass (**m**) moving with speed (**v**), and a motorcycle of mass (**m/4**) moving with speed (**2v**).

The ratio between their kinetic energies $\left(\frac{KE_{\text{car}}}{KE_{\text{motorcycle}}}\right)$ is

equal to:

- a) 1/4
b) 1/2
c) 1
d) 2



26. A gun fires **600 bullets per minute**. If the mass of one bullet is **8 g** and its speed is **700 m/s**, the total kinetic energy of the bullets fired in **one second** is equal to:

- a) $3.92 \times 10^3 \text{ J}$ b) $19.6 \times 10^3 \text{ J}$ c) $58.8 \times 10^3 \text{ J}$ d) $78.4 \times 10^3 \text{ J}$

27. A projectile of mass **10 g** is fired with a speed of **600 m/s** toward a rubber barrier of thickness **8 cm**.

The speed of the projectile at the moment it exits the barrier is **400 m/s**.

(1) The work done by the resistive force of the rubber on the projectile is equal to:

- a) 1 J b) -1 J c) 1000 J d) -1000 J

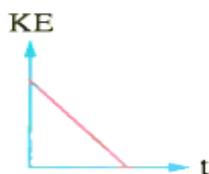
(2) The average resistive force exerted by the rubber on the projectile is equal to:

- a) 12.5 N b) -12.5 N c) 12500 N d) -12500 N

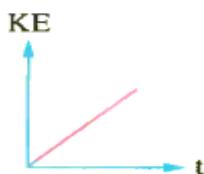
28. A ball of mass (**m**) moves horizontally with speed (**v**). It collides with a wall and the rebounds with **half its initial speed**. The kinetic energy **lost** as a result of the collision is equal to:

- a) $\frac{1}{8}mv^2$ b) $\frac{3}{8}mv^2$ c) $\frac{1}{4}mv^2$ d) $\frac{1}{2}mv^2$

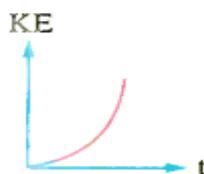
29. Which of the following graphs represents the relationship between the kinetic energy (**KE**) of a body that starts from rest and moves in a straight line with **constant acceleration**, and time (**t**)?



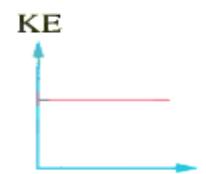
a) A



b) B



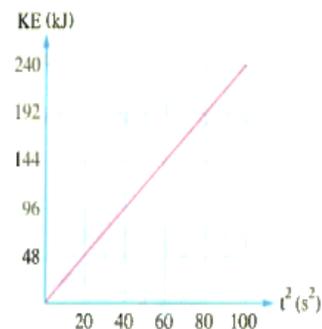
c) C



d) D

30. A car of mass **1200 kg** starts moving from rest in a straight line with **constant acceleration**.

The adjacent graph represents the relationship between the kinetic energy (**KE**) of the car and the square of time (**t²**).



The acceleration of the car is equal to:

- a) 2 m/s²
- b) 4 m/s²
- c) 8 m/s²
- d) 16 m/s²

2-Potential energy

31. The dimensional formula of **potential energy** is

- a) MLT^{-2}
- b) ML^2T^{-2}
- c) ML^2T^{-1}
- d) $ML^{-1}T^{-1}$

32. The energy stored in a compressed spring is

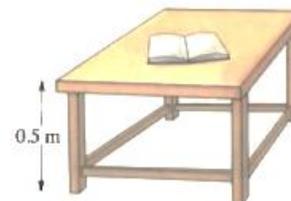
- a) Kinetic energy
- b) Potential energy
- c) Nuclear energy
- d) Thermal energy

33. The adjacent figure shows a table of height **0.5 m** above the ground.

A book of mass **2 kg** is placed on it.

Given that **$g = 9.8 \text{ m/s}^2$** , the potential energy of the book is equal to:

- a) 2.5 J
- b) 9.8 J
- c) 25 J
- d) 98 J



34. An athlete of weight **700 N** climbs a mountain to a height of **200 m** above the ground.

The work done by the athlete against gravity to reach this height is equal to:

- a) $2 \times 10^4 \text{ J}$
- b) $8 \times 10^4 \text{ J}$
- c) $10 \times 10^4 \text{ J}$
- d) $14 \times 10^4 \text{ J}$

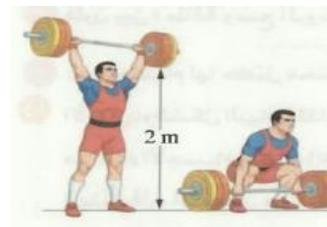
35. The potential energy of a body placed at a point **5 m** above the surface of the Earth is **980 J**.

Given that **$g = 9.8 \text{ m/s}^2$** , the mass of the body is equal to:

- a) 20 kg
- b) 50 kg
- c) 100 kg
- d) 196 kg

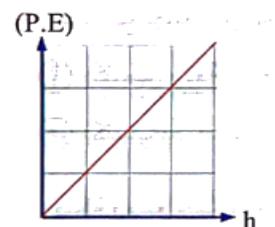
36. The adjacent figure shows a weightlifter lifting a mass of **100 kg**. If the mass is raised to a height of **2 m**, and $g = 10 \text{ m/s}^2$, the work done by the weightlifter to lift this mass is equal to:

- a) 100 J b) 200 J
c) 1000 J d) 2000 J



37. The slope of the straight line in the adjacent graph (**P.E.**) versus **h** represents the of the body.

- a) Mass of the body
b) Weight of the body
c) Displacement of the body
d) Speed of the body



38. The potential energy of a body of mass **1 kg** at the surface of the Earth is equal to:

- a) Zero b) 1 J c) 9.8 J d) 98 J

39. At what height does the potential energy equal **half the weight of the body**?

- a) 0.25 m b) 0.5 m c) 0.75 m d) 1 m

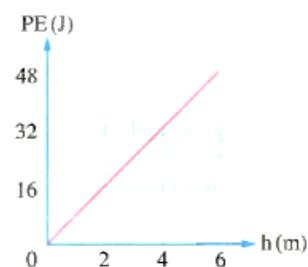
40. A man reaches his apartment by climbing the stairs once and by using the elevator another time. Which of the following statements is correct?

- a) The gravitational potential energy of the man is greater when he climbs the stairs.
b) The gravitational potential energy of the man is greater when he uses the elevator.
c) The man has no gravitational potential energy when using the elevator.
d) The gravitational potential energy of the man is the same in both cases.

41. The adjacent graph shows the relationship between the gravitational potential energy (**P.E.**) of a body and its height (**h**) above the surface of the Earth.

If $g = 9.8 \text{ m/s}^2$, then the mass of the body is equal to:

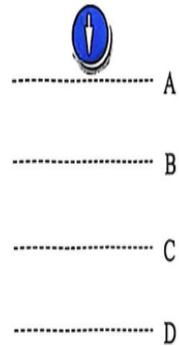
- a) 0.5 kg
b) 0.82 kg
c) 8 kg
d) 78.4 kg



42. You have two boxes **(a)** and **(b)** with weights **40 N** and **60 N**, respectively. Box **(a)** is placed on the surface of the Earth, while box **(b)** is placed at a height of **2 m** above the surface of the Earth. The height to which box **(a)** must be lifted so that its potential energy becomes equal to that of box **(b)** is:

- a) 1.3 m b) 1.5 m c) 3 m d) 5m

43. A metal ball falls through four horizontal levels **A, B, C, and D**, which are separated by equal distances, as shown in the figure. Then



Choose the correct answer according to the table:

	Greatest potential energy	Greatest kinetic energy	Maximum speed at
A	D	A	A
B	A	D	D
C	A	C	B
D	D	D	D

44. An inclined plane reduces the applied force and does not affect the work done because of

- a) Decreasing the displacement
- b) Increasing the displacement
- c) Increasing vertical height
- d) Decreasing vertical height

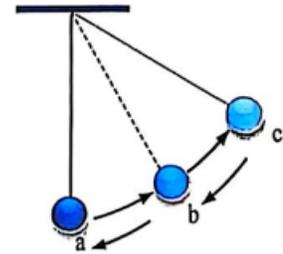
45. When a body is lifted above the surface of the Earth, it gains potential energy.

If the body is lifted to **double the height**, then it

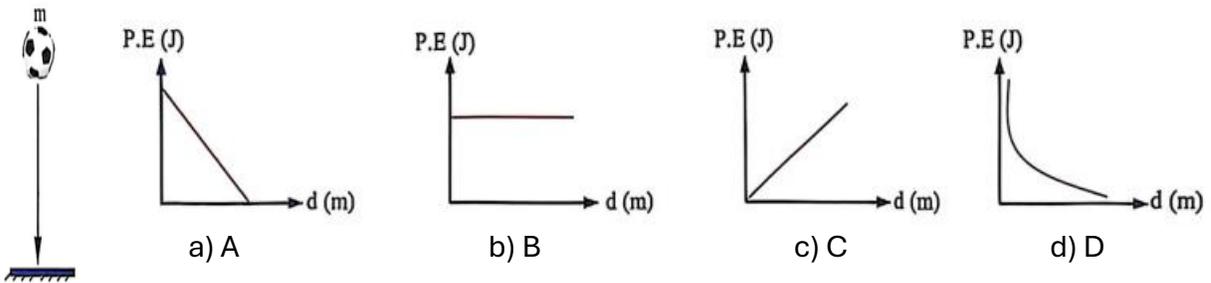
- a) Gains four times the potential energy
- b) Gains double the potential energy
- c) Gains half the potential energy
- d) Gains no additional energy

46. In the adjacent figure, the **maximum potential energy** of the pendulum is at position

- a) **a**
- b) **b**
- c) **c**
- d) **All of the above**

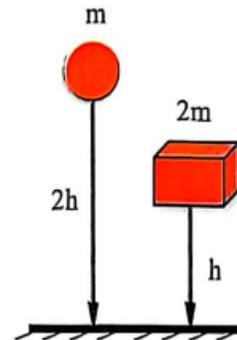


47. The graph that represents the change in the **potential energy (P.E.)** of a body falling freely, as its distance (**d**) from its initial position changes, is



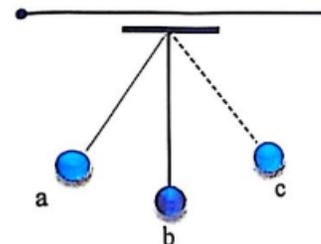
48. In the adjacent figure, there is a **metal ball** and a **wooden box**, where the mass of the box is **twice** the mass of the ball. The height of the ball above the surface of the Earth is **twice** the height of the box. The potential energy of the box is the potential energy of the ball.

- a) One quarter
- b) Half
- c) Double
- d) Equal

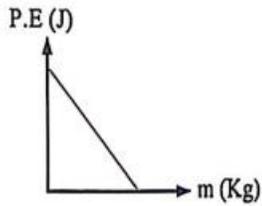


49. In the adjacent figure, if the pendulum moves from **b** to **c**, then the **potential energy**

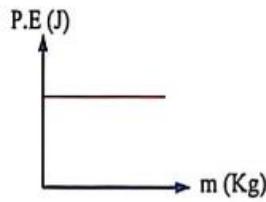
- a) Increases
- b) Decreases
- c) Does not change
- d) Becomes zero



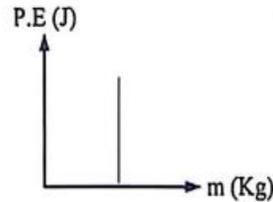
50. The graph that represents the change in **potential energy (P.E.)** of a body of constant mass that is thrown vertically upward is:



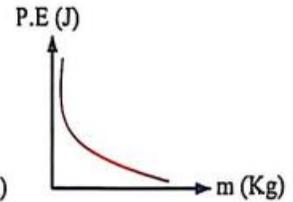
a) A



b) B



c) C



d) D

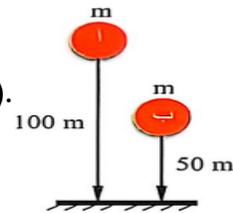
51. The energy stored in the electrons inside a battery is

- a) Potential energy b) Kinetic energy c) Light energy d) Electrical energy

52. Two balls **(A)** and **(B)** are equal in **mass and size**. Ball **(A)** falls from a height of **100 m** above the ground, while ball **(B)** falls from a height of **50 m** above the ground onto a layer of sand.

Then,

- a) Ball **(A)** makes a hole of the same depth as the hole made by ball **(B)**.
 b) Ball **(A)** makes a hole whose depth depends only on its speed.
 c) Ball **(A)** makes a hole **deeper** than the hole made by ball **(B)**.
 d) Ball **(A)** makes a hole **less deep** than the hole made by ball **(B)**.



Chapter 1 – Lesson 3 (Conservation of Energy)

Choose the Correct Answer

1. If a body is thrown vertically upward, then at the **maximum height**, the physical quantity that becomes **zero** is
(a) Force of gravity (b) Acceleration (c) Potential energy (d) Kinetic energy

2. The **mechanical energy** of a body is equal to
(a) The difference between potential energy and kinetic energy
(b) The sum of potential energy and kinetic energy
(c) The ratio of potential energy to kinetic energy
(d) The product of potential energy and kinetic energy

3. **A body has a potential energy of 100 J at the maximum height.** The mechanical energy of the body at the surface of the Earth is J
(a) 100 (b) 200 (c) 50 (d) no correct answer

4. At the maximum height of the pendulum ball, the potential energy is the mechanical energy.
(a) Less than (b) Greater than (c) Equal to (d) no correct answer

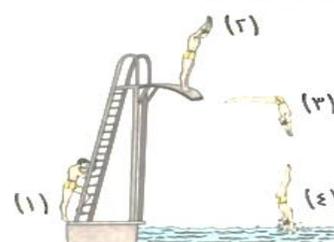
5. When a body is thrown vertically upward, the mechanical energy
(a) Increases (b) Decreases (c) Does not change (d) no correct answer

6. When a body is thrown vertically upward, the kinetic energy becomes **maximum** at
(a) Maximum height (b) Surface of the Earth
(c) At half the distance (d) There is no correct answer

7. When a body is thrown vertically upward, its mechanical energy at the surface of the Earth is its mechanical energy at the maximum height.
(a) Greater than (b) Less than (c) Equal to (d) There is no correct answer

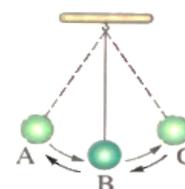
8. When a designer planned a roller-coaster game, he designed the **first hill to be the highest**. This is due to
- (a) Increasing the gravitational force of the Earth on the cars
 (b) Reducing the mechanical energy of the cars
 (c) Reducing air resistance
 (d) Storing the maximum potential energy in the cars

9. In the adjacent figure, the **kinetic energy of the man** is greatest at position



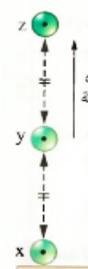
- (a) (1)
 (b) (2)
 (c) (3)
 (d) (4)

10. The adjacent figure shows a **simple pendulum** oscillating between positions **A** and **C**. Then



- (a) The kinetic energy is maximum at **C**
 (b) The mechanical energy at **A** is less than the mechanical energy at **B**
 (c) The potential energy at **A** is maximum
 (d) The potential energy at **C** is less than the potential energy at **A**

11. In the adjacent figure, a body is thrown **vertically upward** from point **(x)** above the surface of the Earth until it reaches its **maximum height** at point **(z)**, neglecting air resistance. If the **kinetic energy** at point **(x)** is **K**, then the **mechanical energy** at point **(y)** is



- (a) $\frac{1}{2}K$ (b) $2K$
 (c) $\frac{1}{4}K$ (d) K

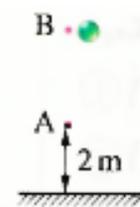
12. A body is thrown vertically upward with a speed of **40 m/s**. If its **potential energy at the maximum height** is **4000 J**, then the mass of the body is

- (a) 1.25 kg (b) 5 kg (c) 50 kg (d) 200 kg

13. In the adjacent figure, a body of mass **10 kg** falls freely from rest. If the **mechanical energy** at point **B** is **800 J**, then the **kinetic energy** at point **A** is equal to

($g = 10 \text{ m/s}^2$)

- (a) 200 J (b) 400 J
 (c) 600 J (d) 800 J



14. A body of mass **0.5 kg** falls freely from rest from a height of **100 m**. Find the **mechanical energy** of the body **after it has fallen 20 m** from the beginning of motion. ($g = 10 \text{ m/s}^2$)
- (a) 100 J (b) 400 J
(c) 500 J (d) 700 J

15. In the adjacent figure, a ball of mass **12 kg** falls freely from rest. If its **mechanical energy** at **half** the distance between the ground and falling position is **150 J**, then its **speed at the moment it reaches the ground** is
- (a) 5 m/s (b) 25 m/s
(c) 50 m/s (d) 100 m/s



16. A body of mass **0.2 kg** is thrown vertically upward with a speed of **20 m/s** ($g = 10 \text{ m/s}^2$). Then:

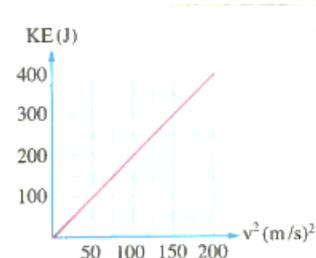
(1) The **maximum height** reached by the body is equal to

- (a) 1 m (b) 20 m (c) 40 m (d) 200 m

(2) The **speed of the body** when it reaches a height of **10 m** above the surface of the Earth is equal to

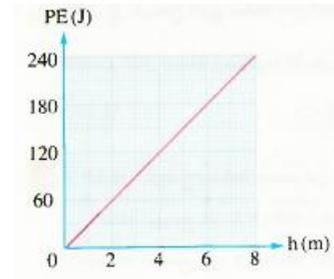
- (a) 14.14 m/s (b) 20.21 m/s
(c) 25.31 m/s (d) 30.42 m/s

17. The adjacent graph represents the relationship between the **kinetic energy (KE)** and the **square of the speed (v^2)** of a body falling from a height of **10 m** above the surface of the Earth. During the fall, the **potential energy** of the body at a height of **2 m** is equal to ($g = 10 \text{ m/s}^2$)



- (a) 20 J (b) 40 J
(c) 60 J (d) 80 J

18. A body is thrown vertically upward from a point above the surface of the Earth until it reaches a height of **8 m**. The adjacent graph shows the relationship between the **potential energy (PE)** of the body and its height (**h**) above the surface of the Earth.
($g = 10 \text{ m/s}^2$)



(1) The **mass of the body** is

- (a) 1 kg (b) 3 kg
(c) 10 kg (d) 30 kg

(2) The **kinetic energy** of the body at a height of **6 m** above the surface of the Earth is

- (a) 60 J (b) 120 J
(c) 180 J (d) 240 J

19. A man lifts a box of mass **5 kg** from the surface of the Earth to a height of **2 m**
($g = 9.8 \text{ m/s}^2$).

(1) The **work done by the man** in lifting the box to this height is equal to

- (a) 36 J (b) 49 J
(c) 90 J (d) 98 J

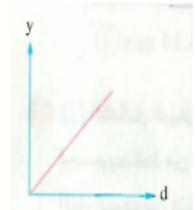
(2) If the box falls freely from this height, the **speed of the box just before hitting the ground** is equal to

- (a) 1.42 m/s (b) 6.26 m/s
(c) 19.6 m/s (d) 39.2 m/s

20. A body of mass (m) falls freely. If its speed at the midpoint between its point of release and the surface of the Earth is (v), then the mechanical energy of the body is equal to

- (a) $\frac{1}{4}mv^2$ (b) $\frac{1}{2}mv^2$
(c) mv^2 (d) $2mv^2$

21. A body falls freely from rest from a height (**h**) above the surface of the Earth. The adjacent graph represents the relationship between the physical quantity (**y**) and the distance (**d**) traveled by the body from its point of release toward the surface of the Earth. The quantity (**y**) represents



- (a) Mass of the body
(b) Kinetic energy of the body
(c) Potential energy of the body
(d) Mechanical energy of the body

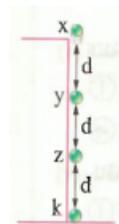
22. The mass of the first body is **three times** the mass of the second body. Both bodies fall freely from rest at the same instant, and the height from which the first body falls is **one third** the height from which the second body falls.

The ratio of the **kinetic energy of the first body** to the **kinetic energy of the second body** at the moment they reach the ground ($\frac{KE_1}{KE_2}$) is equal to

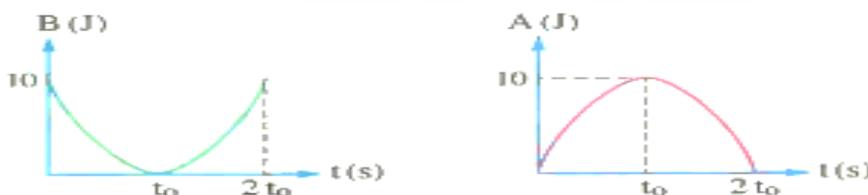
- (a) $\frac{1}{3}$ (b) $\frac{1}{2}$ (c) $\frac{1}{1}$ (d) $\frac{3}{1}$

23. In the adjacent figure, a body falls from rest from the top of a building of height **3d**. Then,

- (a) Potential energy at **x** = kinetic energy at **y**
 (b) Potential energy at **y** > kinetic energy at **k**
 (c) Potential energy at **z** = kinetic energy at **y**
 (d) Potential energy at **x** > kinetic energy at **k**



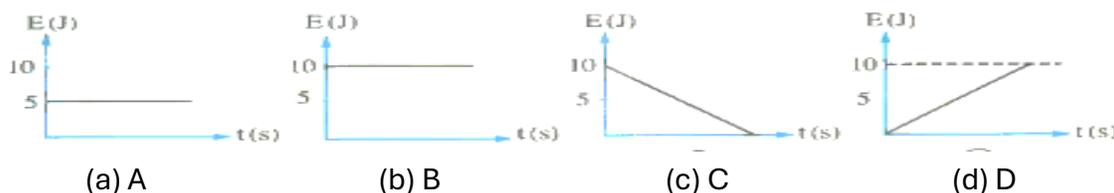
24. Each of the following two graphs shows the relationship between two physical quantities for a body thrown **vertically upward** and **time (t)**.



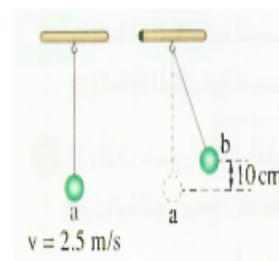
(1) Which of the following choices correctly identifies the quantities **A** and **B** represented on the vertical axes of the two graphs?

	Quantity (A)	Quantity (B)
(a)	Potential energy	Kinetic energy
(b)	Kinetic energy	Potential energy
(c)	Mechanical energy	Kinetic energy
(d)	Mechanical energy	Potential energy

(2) Which of the following graphs represents the relationship between the **mechanical energy (E)** of the body and **time (t)**?



25. A simple pendulum oscillates and passes through point **b** as shown in the adjacent figure ($g = 9.8 \text{ m/s}^2$).



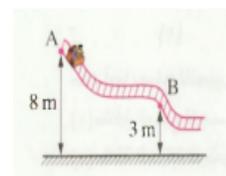
(1) The **maximum height** reached by the pendulum ball above point **a** is

- (a) 20.5 cm (b) 31.9 cm (c) 35.8 cm (d) 36.9 cm

(2) The **speed of the pendulum ball** at point **b** is

- (a) 0.5 m/s (b) 1.2 m/s (c) 2.1 m/s (d) 4.3 m/s

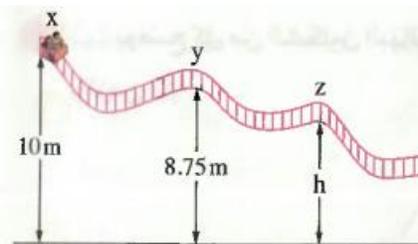
26. A roller coaster car starts from rest at point **A** and moves along the track shown, reaching point **B**. Neglect friction, and take $g = 10 \text{ m/s}^2$.



The **speed of the car** at point **B** is

- (a) 5 m/s (b) 10 m/s
(c) 50 m/s (d) 100 m/s

27. In the adjacent figure, a body of mass **1 kg** starts sliding from rest on a **smooth curved track** starting from point **(x)** ($g = 10 \text{ m/s}^2$).



(1) The **speed of the body** at point **(y)** is equal to

- (a) 3 m/s (b) 5 m/s
(c) 6 m/s (d) 6.5 m/s

(2) If the **speed of the body** at point **(z)** is **7 m/s**, then the **height of point (z)** above the surface of the Earth is equal to

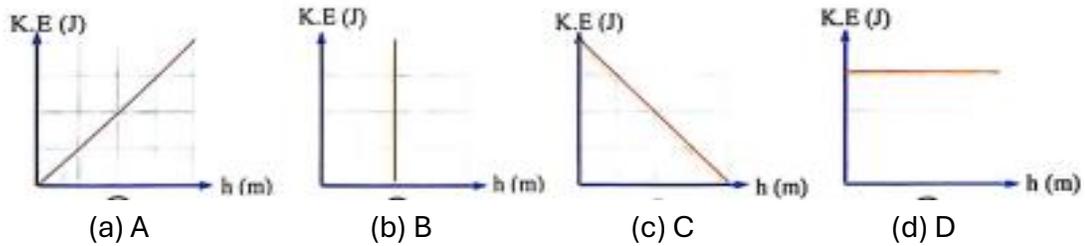
- (a) 8.45 m (b) 7.55 m (c) 7.25 m (d) 6.85 m

28. A ball of mass **0.5 kg** is thrown vertically upward until its speed becomes **3 m/s** at a height of **4 m**.

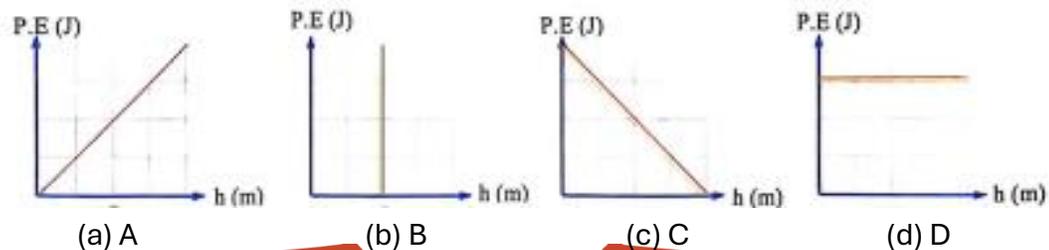
Find the **work done by the ball against the gravitational force**. ($g = 10 \text{ m/s}^2$)

- (a) 2.25 J (b) 17.75 J (c) 20 J (d) 22.25 J

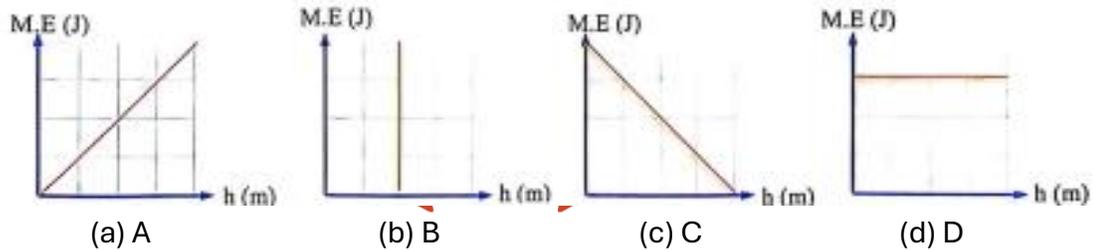
29. The graph that represents the relationship between the **kinetic energy (K.E.)** of a body and its **height (h)** above the surface of the Earth is



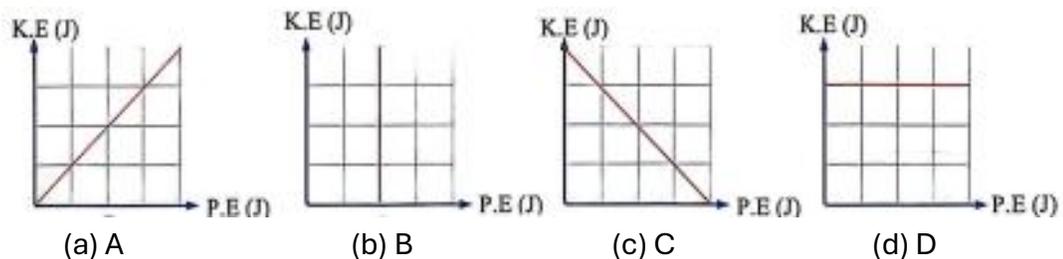
30. The graph that represents the relationship between the **potential energy (P.E.)** of a body and its **height (h)** above the surface of the Earth is



31. The graph that represents the relationship between the **mechanical energy (M.E.)** of a body and its **height (h)** above the surface of the Earth is

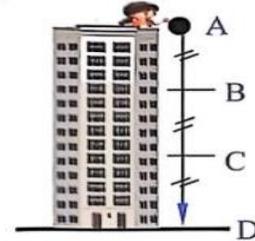


32. The graph that represents the relationship between the **kinetic energy (K.E.)** and the **potential energy (P.E.)** of a body thrown vertically upward is



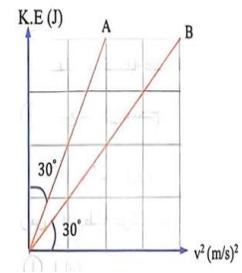
33. A body of mass **0.5 kg** falls freely from rest in the Earth's gravitational field. If its **kinetic energy** after a time **t** is **256 J**, then its **kinetic energy** after a time **2t** from the beginning of the fall is equal to
- (a) 64 J (b) 128 J (c) 512 J (d) 1024 J

34. In the adjacent figure, a ball falls from the top of a building. If the total distance fallen is divided into **three equal distances**, then
- (a) $P.E_D = K.E_A$
 (b) $K.E_C = P.E_B$
 (c) $P.E_C = K.E_B$
 (d) All of the above



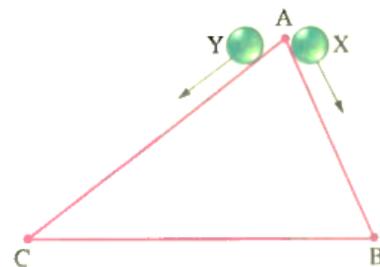
For questions (35) and (36): Study the adjacent figure, then answer:

35. Two bodies with **different masses** fall from the **same height**. Which body has the **greater mass**?
- (a) Body **A** (b) Body **B** (c) two bodies have equal speed



36. The ratio between the masses $\frac{m_A}{m_B}$ of the two bodies is
- (a) 0.33 (b) 1 (c) $\sqrt{3}$ (d) 3

37. In the adjacent figure, two **identical balls (X and Y)** start moving **together** from the same level downward. One ball moves along the **inclined plane (AB)**, and the other moves along the **inclined plane (AC)**. Which of the following statements is correct **when the two balls reach points (B) and (C), neglecting friction?**
- (a) The **mechanical energy** of ball **X** is greater
 (b) The **speed** of ball **X** is greater
 (c) The **mechanical energy** of ball **Y** is greater
 (d) The **speeds of the two balls are equal**



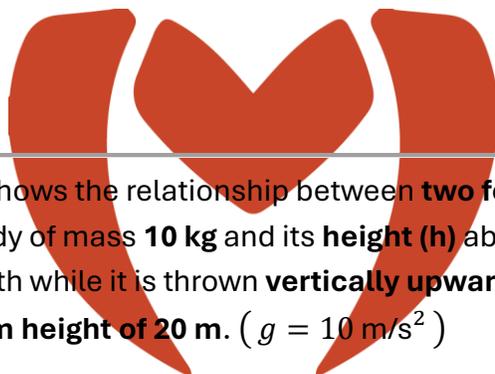
Essay questions

38. A body of mass **4 kg** falls freely from rest from a height of **20 m** above the surface of the Earth. Complete the blanks in the following table, taking $g = 10 \text{ m/s}^2$

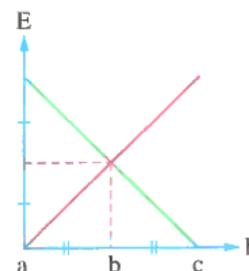
Point	Displacement from the point of fall (m)	Potential Energy (J)	Speed (m/s)	Kinetic Energy (J)	Mechanical Energy (J)
(1)	0	.....	.....	.....	.....
(2)	.....	.....	5	.....	.....
(3)	.....	400	.....	.....	.....
(4)	.....	.....	.....	800	.....

From the results you obtained, determine the point during the fall at which:

- The **mechanical energy** of the body is equal to its **kinetic energy**.
- The **mechanical energy** of the body is equal to its **potential energy**.



39. The adjacent graph shows the relationship between **two forms of energy (E)** for a body of mass **10 kg** and its **height (h)** above the surface of the Earth while it is thrown **vertically upward** until it reaches a **maximum height of 20 m**. ($g = 10 \text{ m/s}^2$)



- Which of the two straight lines represents **potential energy**, and which represents **kinetic energy** of the body?
- Calculate the **values of potential energy and kinetic energy** of the body at points **(a), (b), and (c)**.
- Calculate the **speed of the body** at points **(a), (b), and (c)**.
- Calculate the **mechanical energy** of the body.

40. Walid and Marwan live in a building. Walid drops a ball from the **second floor**, while Marwan drops **another ball of the same mass** from the **third floor**, as shown in the figure.



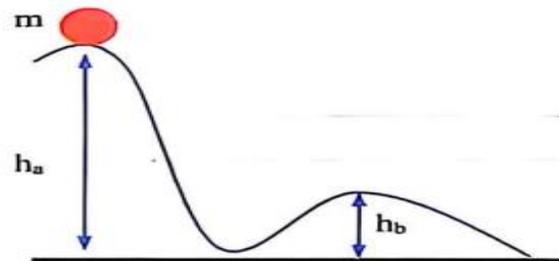
The two balls fall freely toward the surface of the Earth.

Explain which ball has:

- (a) Greater **potential energy** at the moment of release.
- (b) Greater **kinetic energy** at the moment it hits the ground.
- (c) Greater **mechanical energy**.

41. Ball of mass (**m**) moves from rest along the **curved track** shown in the figure.

Prove that: $v_b = \sqrt{2g(h_a - h_b)}$



.....

.....

.....

.....

42. In an experiment to measure **kinetic energy** using an **air track**, the following results were obtained:

$\frac{1}{m} \text{ (kg}^{-1}\text{)}$	1	2	3	4
$v^2 \text{ (m}^2\text{/s}^2\text{)}$	2	4	X	8

(1) Draw the graph showing the relationship between $\frac{1}{m}$ on the **horizontal axis** and v^2 on the **vertical axis**.

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(2) **From the graph, find:**

- (a) The value of X =
- (b) The kinetic energy of the body =

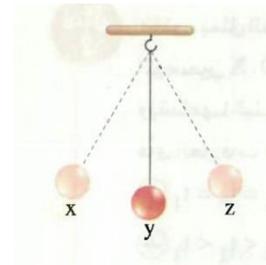
Chapter 2 – Lesson 1 (Oscillatory Motion)

1- The periodic time of an oscillating body is

- A) The number of oscillations per second
- B) The time taken to complete one full oscillation
- C) The maximum displacement from the mean position
- D) The distance covered in one second

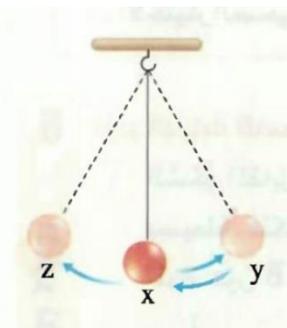
2- In the opposite figure, the pendulum completes one full oscillation when it moves as follows

- A) $y \leftarrow x$
- B) $z \leftarrow y \leftarrow x$
- C) $y \leftarrow z \leftarrow y \leftarrow x$
- D) $x \leftarrow y \leftarrow z \leftarrow y \leftarrow x$



3- In the opposite figure shows a simple pendulum with amplitude A. If the pendulum moves from position x to y then to z, the displacement from x equals

- A) A
- B) 2A
- C) 3A
- D) Zero



4- At the maximum displacement of an oscillating body, the velocity of the body is

- A) Maximum velocity
- B) Half of maximum velocity
- C) zero
- D) One-third of maximum velocity

5- Which of the following formulas expresses the period (T) in terms of the number of oscillations (N) and time (t).....

- A) $T = N / t$
- B) $T = N \times t$
- C) $T = t / N$
- D) $T = 1 / N$

6- The correct relationship between frequency (ν) and period (T) is.....

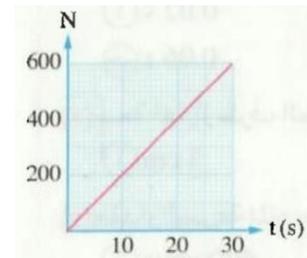
- A) Direct relationship
- B) Inverse relationship
- C) No relationship
- D) Quadratic relationship

7- If the periodic time of an oscillating body is 0.5 s, its frequency is

- A) 0.5 Hz
- B) 1 Hz
- C) 2 Hz
- D) 5 Hz

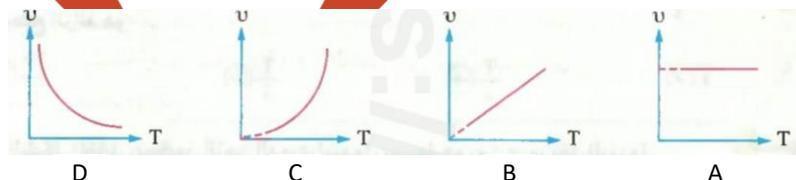
8- The graph representing the relationship between the number of oscillations (N) and time (t) shows that the frequency is

- A) 10 Hz
- B) 20 Hz
- C) 40 Hz
- D) 800 Hz



9- Which of the following graphs represents the relationship between frequency and periodic time

- A)
- B)
- C)
- D)



10- The time taken by a vibrating body to reach its maximum displacement equals.....

- A) T
- B) $1/2 T$
- C) $1/4 T$
- D) $3/4 T$

11- A pendulum makes a displacement equivalent to during a periodic time of 2 seconds.

- A) Quarter of a complete vibration
- B) Half of a complete vibration
- C) Double a complete vibration
- D) Zero

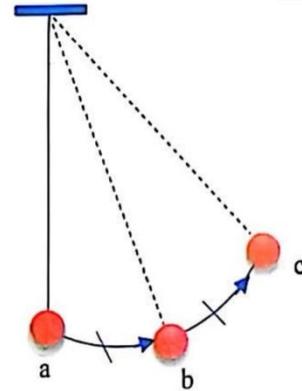
12- In the given figure, during the oscillation of a pendulum and while the pendulum moves in the shown direction:

a- The kinetic energy of the pendulum.....

- A) Decreases
- B) Increases
- C) Remains constant

b- The potential energy of the pendulum.....

- A) Decreases
- B) Increases
- C) Remains constant

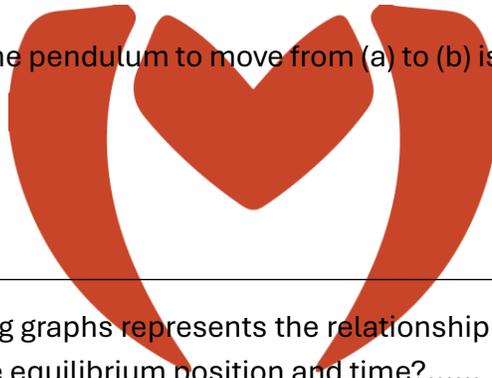


c- The sum of kinetic and potential energies at point (b) is the potential energy at (c)

- A) Greater than
- B) Less than
- C) Equal to

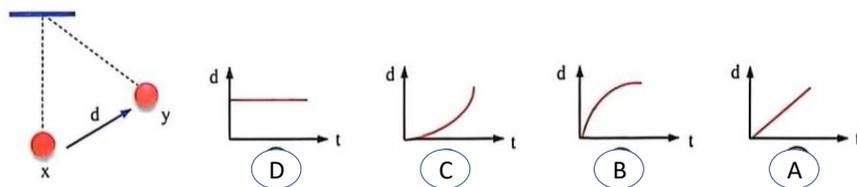
d- The time taken for the pendulum to move from (a) to (b) is the time taken from (b) to (c)

- A) Greater than
- B) Less than
- C) Equal to



13- Which of the following graphs represents the relationship between the displacement of a pendulum bob from the equilibrium position and time?.....

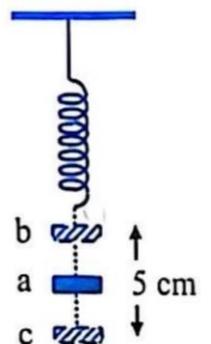
- A) Graph (A)
- B) Graph (B)
- C) Graph (C)
- D) Graph (D)



14- The given figure represents the motion of a body suspended from a spring:

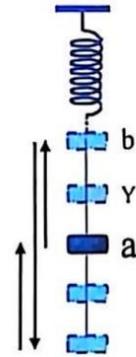
a- The amplitude of oscillation equals.....

- A) 5 cm
- B) 2.5 cm
- C) 10 cm
- D) 20 cm



16- If the time taken by a vibrating body to move from the equilibrium position (a) to point (y), which lies midway between (a) and (b), is (t), then the time required to complete one full oscillation is.....

- A) 2t
- B) 4t
- C) 8t
- D) 12t



17- For pendulums X and Y, the ratio between their periodic time (T_x / T_y) equals $1/4$. Find the ratio between their frequencies (ν_x / ν_y).....

- A) $1/4$
- B) $1/2$
- C) 2
- D) 4

18- For a vibrating body, the ratio of the periodic time to the frequency equals $\frac{1}{625} \text{ s}^2$, the number of oscillations produced by the body during 25 s is oscillations.

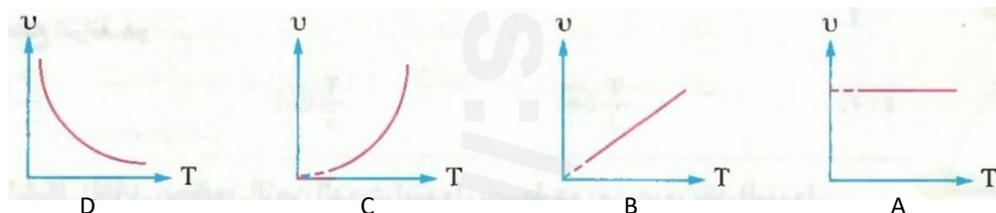
- A) 25
- B) 125
- C) 425
- D) 625

19- If the time required for one complete oscillation is 0.1 s, the number of oscillations in 100 s equals oscillations

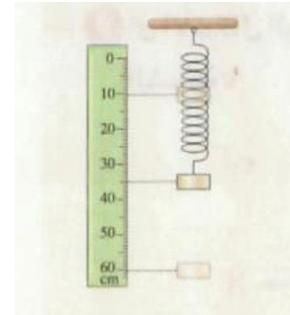
- A) 10
- B) 100
- C) 1000
- D) 10000

20- The given graph represents the relation between frequency (ν) and period (T) of a body in simple harmonic motion. Which graph is correct.....

- (A)
- (B)
- (C)
- (D)

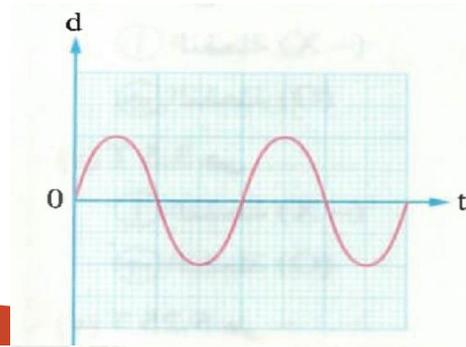


21- In the opposite figure, an object is suspended from a vertical spring next to a graduated ruler such that it oscillates between the marks 10cm and 60 cm. The distance traveled by the object during two complete oscillations is

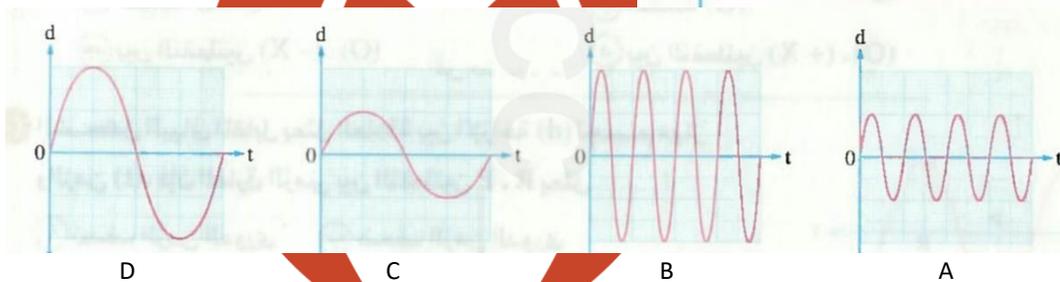


- (A) 25cm
- (B) 50cm
- (C) 100cm
- (D) 200 cm

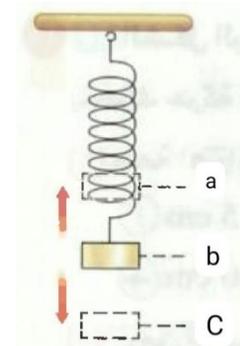
22- Simple pendulum oscillates with frequency (ν) and amplitude, the graph shows the relationship between the displacement (d) of the pendulum and time(t). If we modify the length of the pendulum string and the work done on the pendulum to double both the frequency and the amplitude of oscillation, which of the following graphs represents the new relationship between displacement (d) and time (t).....



- (A)
- (B)
- (C)
- (D)



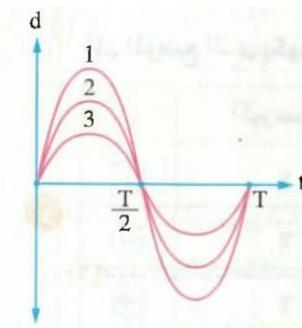
23- In the opposite figure, a body is suspended from a vertical spring. The body is pulled downward from point (b) to point (a), then released to move in simple harmonic motion. the mechanical energy of the body is Neglecting air resistance



- (A) Maximum at point (a)
- (B) Maximum at point (b)
- (C) Minimum at point (b)
- (D) Constant at all points

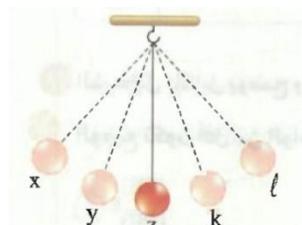
24- Three identical bodies perform simple harmonic motion, the graph shows the relationship between displacement (d) and time (t) for each body, the correct arrangement of these bodies according to their mechanical energy is.....

- (A) $1 > 2 > 3$
 (B) $3 > 2 > 1$
 (C) $1 > 3 > 2$
 (D) $1 = 2 = 3$



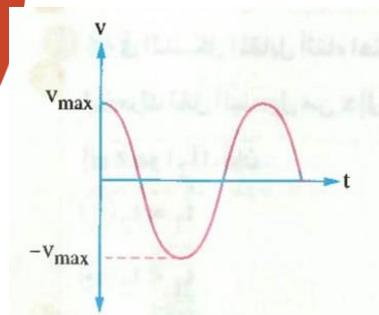
25- The figure shows a simple pendulum moving from point X to point L, the distances XY, YZ, ZK, and KL are equal, if the time taken to move from X to Y is t , then the periodic time of the pendulum is.....

- (A) Equal to $8t$
 (B) Less than $8t$
 (C) Greater than $8t$
 (D) Cannot be determined

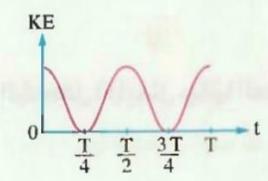
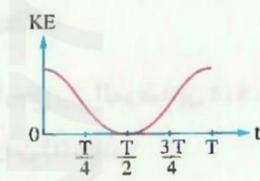
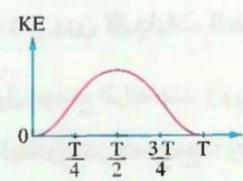
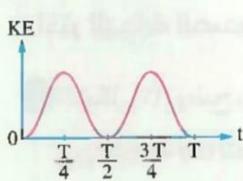


26- The graph shows the relationship between the velocity (v) of a simple pendulum and time (t), when it was observed starting from.....

- (A) its original equilibrium position
 (B) its maximum displacement position
 (C) a position where the pendulum has maximum possible potential energy
 (D) the midpoint between its original equilibrium position and its maximum displacement position



27- A simple pendulum moves a simple harmonic motion, starting its motion from its maximum displacement from its original equilibrium position at $t=0$ and completing a full oscillation in time T , Which of the following graphs represents the relationship between the kinetic energy (KE) of the pendulum and time (t)

- (A) 
- (B) 
- (C) 
- (D) 

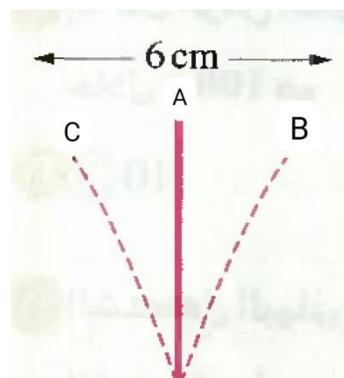
28- In the opposite figure shows a vibrating elastic rod takes a time of 0.01 s to move from point (A) to point (B) then:

a-The periodic time of the rod's motion is

- (A) 0.02 s
- (B) 0.04 s
- (C) 0.06 s
- (D) 0.08 s

b-The amplitude of vibration of the rod is

- (A) 3 cm
- (B) 6 cm
- (C) 9 cm
- (D) 12 cm



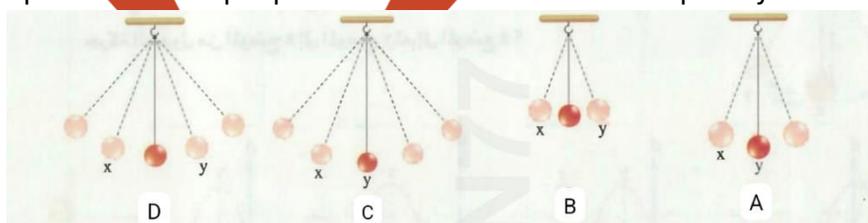
c-The average speed of the rod's during its motion from point (B) to point (C)

- (A) 75 cm/s
- (B) 150 cm/s
- (C) 300 cm/s
- (D) 600 cm/s

29- Each of the following figures represents a simple pendulum in which the time taken by the pendulum to move from point X to point Y is the same

Which of these figures represents a simple pendulum with the lowest frequency?

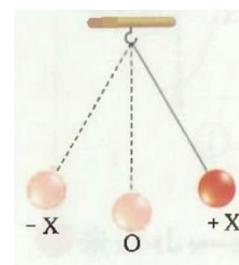
- (A)
- (B)
- (C)
- (D)



30- The figure shows a simple pendulum moving from point (+X) in a simple harmonic motion with a periodic time (T)

a-The position of the pendulum after a time equal to 2T is.....

- (A) Point (-X)
- (B) Point (+X)
- (C) Point (O)
- (D) Between points (O) and (+X)



b-The position of the pendulum after a time equal to $3.5T$ is.....

- (A) Point (-X)
- (B) Point (+X)
- (C) Point (O)
- (D) Between points (O) and (-X)

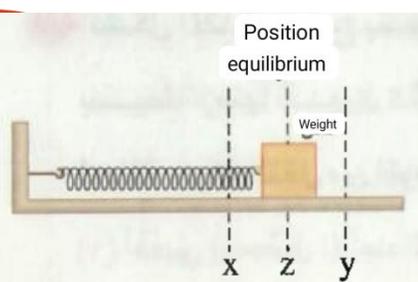
c-The position of the pendulum bob after a time equal to $5.25T$ is.....

- (A) Point (+X)
- (B) Point (O)
- (C) Between points (O) and (+X)
- (D) Between points (O) and (-X)

31- The figure represents a weight placed on a smooth horizontal surface and connected to a spring coil, moving in a simple harmonic motion, at a certain instant, the mass passes through position Z with a speed of 0.5 m/s to the left, after completing half an oscillation from that instant, what will be the position of the mass and its speed.....

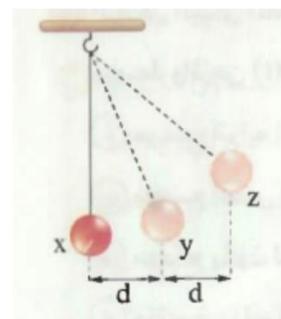
- (A)
- (B)
- (C)
- (D)

Speed of weight	Position of weight	
Zero	z	A
0.5 m/s to the right	y	B
Zero	x	C
0.5 m/s to the right	z	D



32- In the opposite figure, during the oscillation of the pendulum, the time required for the pendulum to move from X to Y is (t_1), and the time required to move from Y to Z is (t_2). Which of the following is correct?.....

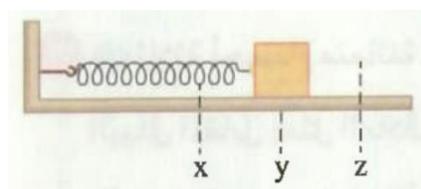
- (A) $t_1 = t_2$
- (B) $t_1 > t_2$
- (C) $t_1 < t_2$
- (D) Cannot be determined



33- The opposite figure represents a body connected to a spring and oscillating between two positions X and Z, At which position does the body has.....

- (A)
- (B)
- (C)
- (D)

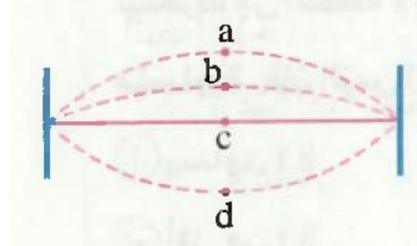
	Maximum speed	Minimum potential energy
A	Y	Y
B	Z	Y
C	Y	Z
D	Z	Z



34- The adjacent figure shows a horizontally vibrating string.

Which of the following ratios of potential energy is less than one?

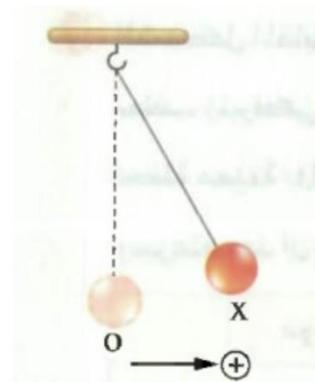
- (A) $\frac{(PE)_a}{(PE)_c}$
 (B) $\frac{(PE)_d}{(PE)_a}$
 (C) $\frac{(PE)_b}{(PE)_d}$
 (D) $\frac{(PE)_a}{(PE)_b}$



35- The adjacent figure shows a simple pendulum moving in a simple harmonic motion with a periodic time of 2 s, the time required from the moment the pendulum starts moving from position X until it reaches:

a-The maximum displacement in the negative direction for the first time equals.....

- (A) 0.5 s
 (B) 1 s
 (C) 1.5 s
 (D) 2 s



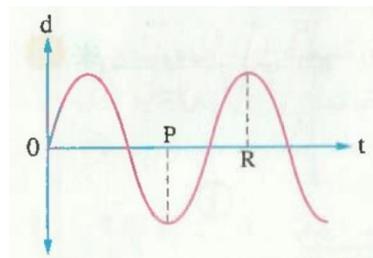
Positive direction of motion

b-The maximum speed for the first time equals.....

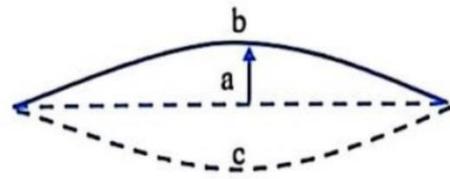
- (A) 0.5 s
 (B) 1 s
 (C) 1.5 s
 (D) 2 s

36-The opposite graph represents the relationship between the displacement (d) of an oscillating body and time (t). The time difference between points P and R represents

- (A) Half of the periodic time
 (B) Double the periodic time
 (C) The periodic time
 (D) One-quarter of the periodic time



37- In the adjacent figure, if the string is pulled from its position of rest at point (a) to point (b) and then released to vibrate until it comes to rest, which of the following graphical representations expresses the displacement-time (d-t) relation of the motion?

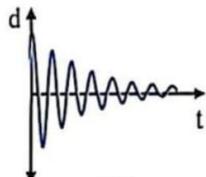


(A)

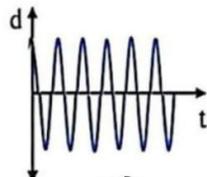
(B)

(C)

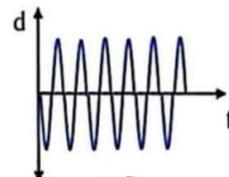
(D)



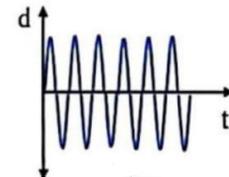
D



C



B



A

38- Figure (1) shows a pendulum whose equilibrium position is at Y, oscillating between positions X and Z, figure (2) graphically represents the relationship between the displacement (d) of the pendulum from position X and time (t) then:

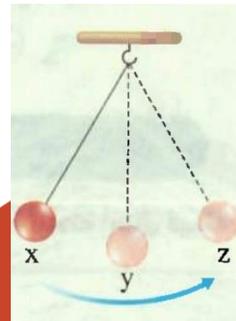


Fig. (1)

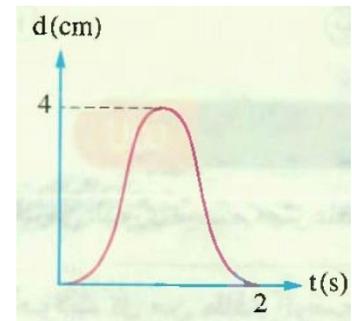


Fig. (2)

a- The amplitude of oscillation of the pendulum equals.....

(A) 1 cm

(B) 2 cm

(C) 4 cm

(D) 8 cm

b- The frequency of the pendulum equals.....

(A) 0.25 Hz

(B) 0.5 Hz

(C) 2 Hz

(D) 4 Hz

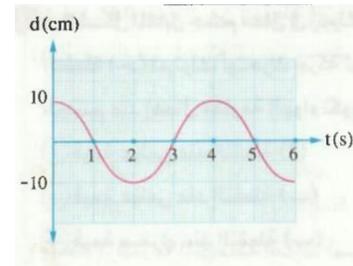
39- The adjacent graph represents the relationship between the displacement (d) of a body performing simple harmonic motion and time (t). Then:

a- The amplitude of oscillation of the body equals.....

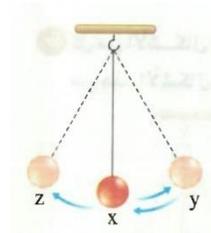
- (A) 5 cm
- (B) 6 cm
- (C) 10 cm
- (D) 20 cm

b- The periodic time of the motion equals.....

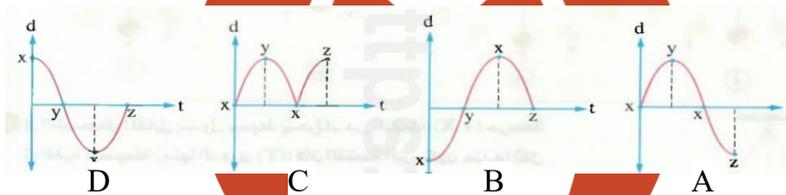
- (A) 2 s
- (B) 3 s
- (C) 4 s
- (D) 6 s



40- Which of the following graphs represents the relationship between the displacement (d) from position X of the pendulum shown in the adjacent figure and time (t), when the pendulum moves from position X to position Y and then to position Z?



- (A)
- (B)
- (C)
- (D)

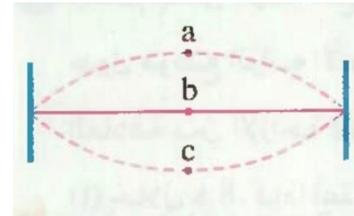


Essay questions

41- The adjacent figure shows a horizontally stretched string vibrating vertically.

(1) At which of the indicated points does the string have:

- a) The maximum speed?
- b) The maximum potential energy?



(2) Find the ratio between the time taken for the string to move from point (b) to point (c) and the time taken for it to move from point (b) to point (a).

.....

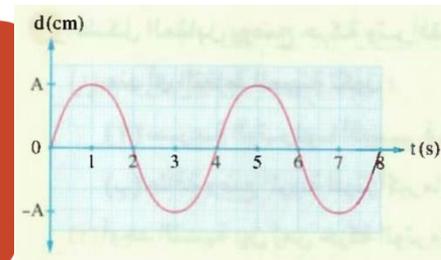
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42- A body is suspended by a string and pushed to the right, so it oscillates to the right and left about its original equilibrium position.

The opposite graph represents the relationship between the displacement (d) of the body and time (t) during 8 s, if the direction of motion to the right is considered the positive direction, then at which instant(s) during this interval is the body:



- (1) Moving to the right with maximum speed?
- (2) Moving to the left with maximum speed?
- (3) Momentarily at rest?

.....

.....

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.....

Chapter 2 – Lesson 2 (Waves)

Choose the Correct Answer

1. Waves transmit in the direction of their propagation.
a) matter b) particles c) energy d) water

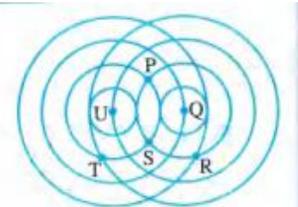
2. When a wave is transmitted from air to water, its frequency
a) Increases b) Decreases c) Remains constant

3. When the particles of the medium vibrate in a direction **perpendicular** to the direction of propagation of the wave motion, the wave is called
a) Longitudinal b) Transverse c) Both of them

4. When the particles of the medium vibrate in the same direction as the direction of propagation of the wave motion, the wave is called
a) Longitudinal b) Transverse c) Standing d) Electromagnetic

5. The opposite figure represents **two waves interfering on the surface of water**. Which two points in the figure represent the **sources of these waves**?

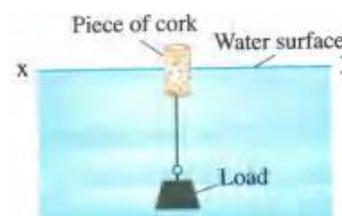
- a) P, S b) T, R
c) Q, T d) U, Q



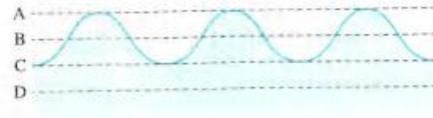
6. The opposite figure shows a wave propagating on the surface of a still lake, so this wave propagates in
a) one direction with increasing speed
b) two opposite directions with two different speeds
c) all directions with the same speed
d) all directions with increasing speed



7. A **load is suspended to a piece of cork** that floats on the **surface of water**, as shown in the figure. When a **wave passes on the surface of water in the direction from x to y**, in which direction does the **piece of cork move**?
a) Right and left b) Up and down
c) From x to y d) From y to x

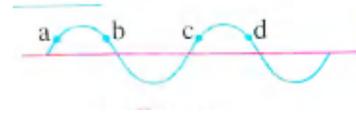


8. A **train of waves** passes on the **water surface of a lake**, as shown in the opposite figure. What will be the **level at which the surface of water settles after the waves finish passing?**



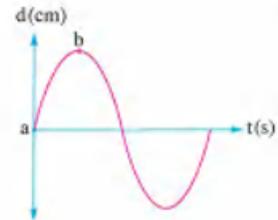
- a) A b) B c) C d) D

9. In the opposite wave, which of the points **a, b, c, d** have the **same phase?**



- a) a, b, c b) a, b c) b, c d) b, d

10. The opposite figure represents the relation between the **vertical displacement (d)** of one of the medium particles and the **time (t)** for a **transverse wave** of frequency equal to **50 Hz**. Then, the **time interval taken by the medium particle to move between the two points a and b** is



- a) 2/25 s b) 1/25 s c) 1/50 s d) 1/200 s

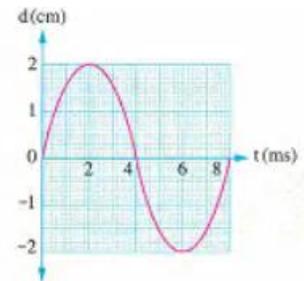
11. The opposite figure represents a **transverse wave**, so:

(i) The amplitude of this wave is

- a) 2 cm b) 3 cm c) 4 cm d) 6 cm

(ii) The frequency of this wave is

- a) 100 Hz b) 125 Hz c) 250 Hz d) 500 Hz



12. If the **time interval between passing the first crest and the tenth crest** by a point in the path of a wave motion is **0.2 s**, then the **frequency** is

- a) 45 Hz b) 50 Hz c) 55 Hz d) 60 Hz

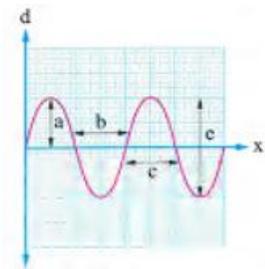
13. A girl dropped a stone in a **water pond** and watched the formed waves.

She found that **18 waves collided with the edge during 10 s.**

If the **distance between every two successive crests is 12 cm**, so,

	The wavelength (cm)	The frequency (Hz)
a)	24	1.8
b)	24	0.6
c)	12	1.8
d)	12	0.6

14. The opposite graph represents the relation between the **displacement (d)** of the particles of a medium in which a **transverse wave** propagates with **frequency ν** , **amplitude A**, and the **distance (x)** travelled by the wave, if:



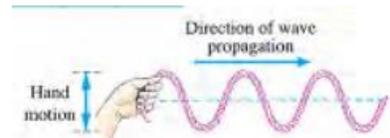
(i) The **frequency of the wave is doubled at constant amplitude**, then the distance

- a) a increases to the double
- b) b increases to the double
- c) c decreases to its half
- d) e decreases to its half

(ii) The **amplitude of the wave is doubled at constant frequency**, then the distance

- a) a decreases to its half
- b) b decreases to its half
- c) c increases to the double
- d) e increases to the double

15. In the opposite wave, if the **distance between the first crest and the third trough is 100 cm**, then the **wavelength of this wave** equals



- a) 10 cm
- b) 20 cm
- c) 40 cm
- d) 70 cm

16. The following figures show **four sources of waves**.

Which of them produces **longitudinal waves** in its surrounding medium?



a) Light bulb



b) Horn speaker



c) TV remote control



d) Water surface waves

17. If the distance between two successive points that have the same phase in a wave is **20 cm**, then the wavelength of this wave equals

- a) 5 cm b) 10 cm c) 20 cm d) 40 cm

18. If the distance between a compression center and the next rarefaction center is **8 cm**, then the wavelength equals

- a) 4 cm b) 8 cm c) 16 cm d) 32 cm

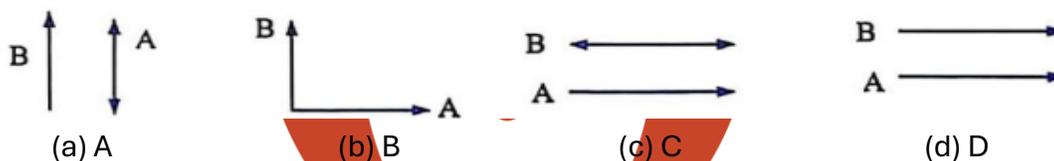
19. The name given to **half the vertical distance** between the crest and the trough of a transverse wave is

- a) Frequency b) Wavelength c) Displacement d) Amplitude

20. If the horizontal distance between a crest and the following trough is **10 cm**, then the wavelength equals

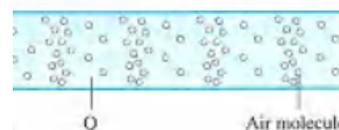
- a) 5 cm b) 10 cm c) 20 cm d) 40 cm

21. The directional representation of a **longitudinal wave**, showing the direction of wave propagation (**A**) and the vibration of the medium particles (**B**) is

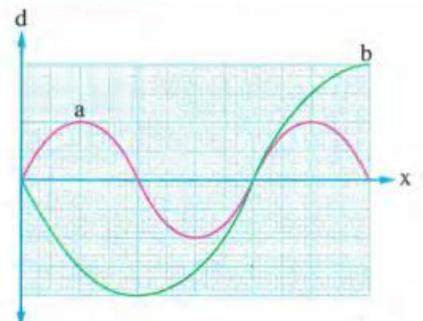


22. The opposite figure represents a **model of a sound wave propagating through air inside a tube opened from both ends**. How can **region Q** be described?

- a) A region of **high density** which is called **compression**.
 b) A region of **low density** which is called **compression**.
 c) A region of **high density** which is called **rarefaction**.
 d) A region of **low density** which is called **rarefaction**.



23. The opposite graph represents the relation between the **displacement (d)** of the particles of a medium in which **two sound waves (a) and (b)** propagate and the **distance (x)** travelled by the two waves **in the same time interval**, so:



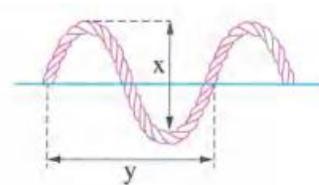
(i) The ratio between the **frequencies of the two waves** $\frac{v_a}{v_b}$ is

- a) 1/1 b) 2/1 c) 1/2 d) 1/4

(ii) The ratio between the **amplitudes of the two waves** $\frac{A_a}{A_b}$ is

- a) 1/1 b) 2/1 c) 1/2 d) 4/1

24. The opposite figure represents a **wave propagating in a rope**. Then, this wave is

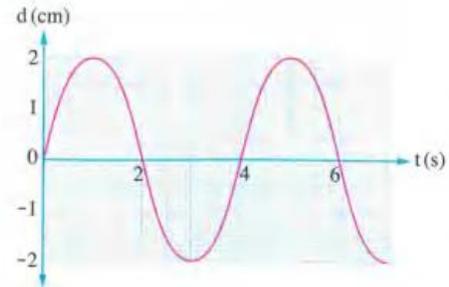


- a) a longitudinal wave of wavelength **x**
 b) a longitudinal wave of wavelength **y**
 c) a transverse wave of wavelength **x**
 d) a transverse wave of wavelength **y**

25. What is the **characteristic that describes all the longitudinal waves and does not describe all the transverse waves?**

- a) They can be travelling waves.
 b) They require a medium in order to propagate.
 c) They transfer energy in the direction of their propagation.
 d) Their speed of propagation differs from medium to another.

26. The opposite graph represents the relation between the **displacement (d)** of one of the **medium particles** and the **time (t)**. Then, the wave represented by the graph

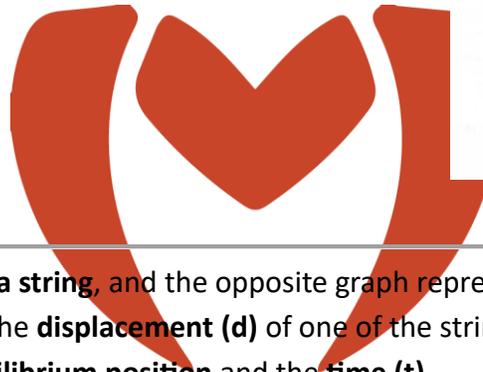
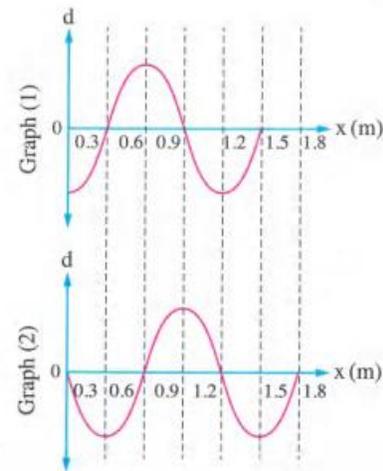


- a) could be transverse or longitudinal of amplitude **2 cm**
- b) is certainly not longitudinal and its amplitude is **2 cm**
- c) could be transverse or longitudinal of amplitude **4 cm**
- d) is certainly not transverse and its amplitude is **4 cm**

27. **Graph (2)** represents the **position of a travelling wave in a string** after **0.025 s** from its position that is represented in **graph (1)**.

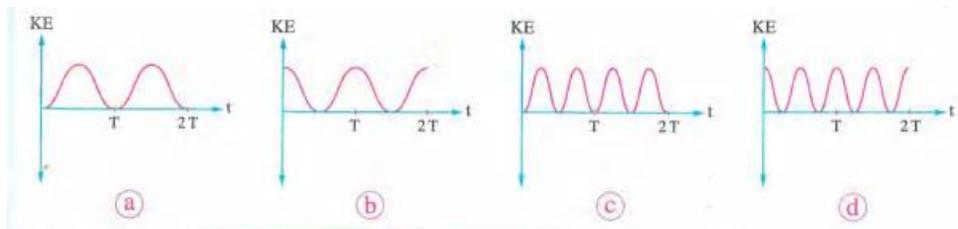
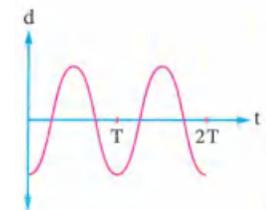
Then, the **frequency of the wave** equals

- a) 7.5 Hz
- b) 10 Hz
- c) 15 Hz
- d) 30 Hz



28. A **wave propagates in a string**, and the opposite graph represents the relation between the **displacement (d)** of one of the string particles about its **equilibrium position** and the **time (t)**.

Which of the following graphs represents the relation between the **kinetic energy (KE)** of this particle and the **time (t)**?



29. The opposite figure represents a **source vibrating with a frequency of 4 Hz**, producing waves that propagate on the **surface of water** with a **speed of 0.4 m/s** as **concentric circular ripples** around the source. Given that **each circle represents a crest**, the **distance between the second and the fifth crest** equals
- a) 0.1 m b) 0.2 m c) 0.3 m d) 0.5 m

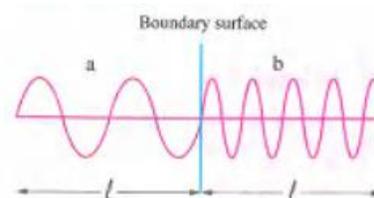


30. A **small stone has fallen into a pond of still water**, and **circular waves** are formed on the water surface as shown in the opposite figure, where **each circle represents a crest of a wave**. If the **speed of the water waves is v** and their **wavelength is λ**, then the **time taken by the disturbance to move from point P to point Q** equals

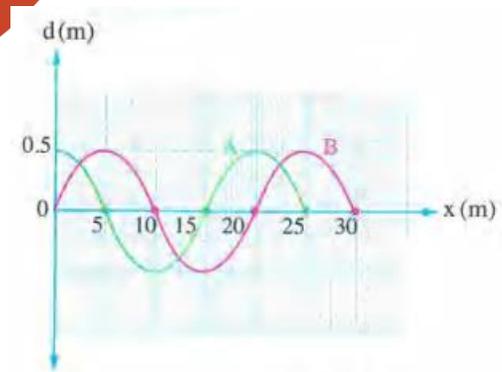


- a) $\frac{\lambda}{2v}$ b) $\frac{\lambda}{v}$ c) $\frac{3\lambda}{2v}$ d) $\frac{2\lambda}{v}$

31. The opposite figure shows a **wave travelling through medium (a)**, then moving into **another medium (b)**. So, the **ratio between the speed of the wave in medium (a) to its speed in medium (b)** $\frac{v_a}{v_b}$ is
- a) 9/4 b) 4/9 c) 2/1 d) 1/2



32. In the opposite graph, **curve A** represents the relation between the **vertical displacement (d)** of the medium particles and the **horizontal distance (x)** covered by the wave at a **certain instant**, while **curve B** represents the same relation for the **same wave after passing 2 s**. Then, the **speed of wave propagation** equals



- a) 1.25 m/s b) 2.5 m/s
c) 5 m/s d) 40 m/s

33. The vertical distance between a crest and its successive trough in a transverse wave equals the horizontal distance between them.

If the speed of the wave is 3.2 m/s and its frequency is 16 Hz, then its amplitude equals

..... .

- a) 0.5 m b) 0.2 m c) 0.1 m d) 0.05 m

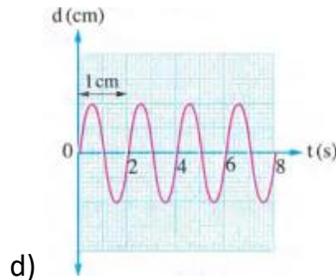
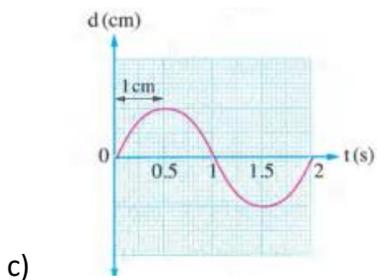
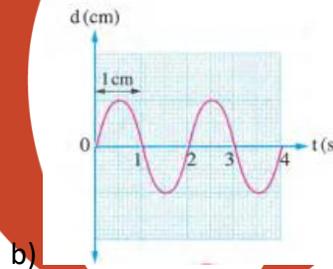
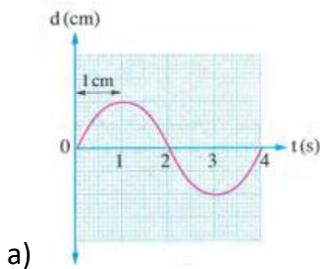
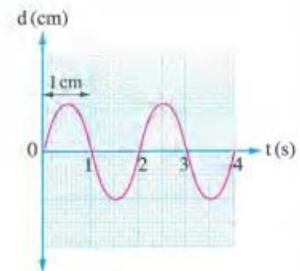
34. A stationary ship A sends two sound signals to another stationary ship B, one signal through air and the other through water. If the signal that is transmitted in air reaches ship B after the signal transmitted in water by 6 s, then the distance between the two ships is

(Given that: the speed of sound in air is 340 m/s and in water is 1480 m/s)

- a) 3.8×10^{-4} km b) 2.65 km c) 1658.9 km d) 2648.42 km

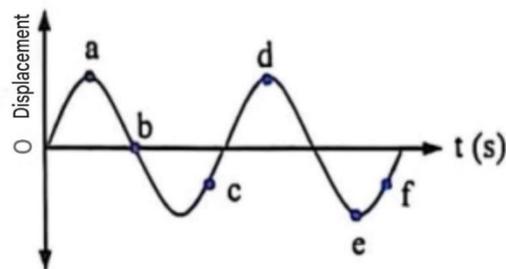
35. The opposite graph represents a **wave travelling through a medium with a speed v.**

If the wave has moved to **another medium** where its **speed becomes 2v**, then the graph which represents the wave in the **second medium** will be

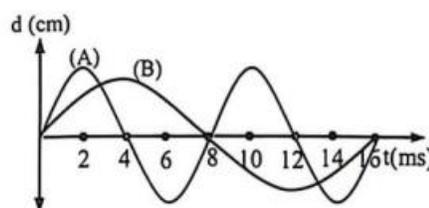


36. The adjacent figure illustrates the relationship between **displacement and time** for a **transverse wave**. Choose from the following table, the **pairs of points** whose **phase difference** equals

	360°	270°	180°	90°
a)	df	ae	ad	ab
b)	de	ad	cd	ef
c)	ad	bd	de	ab
d)	dc	ad	ab	dc



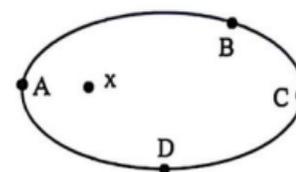
37. The adjacent figure shows the graphical relationship between displacement and time for two different waves propagating in the same medium.



Which of the following choices expresses the relationship between

	Frequency (v)	Wave speed (V)
a)	$v_A = \frac{1}{4}v_B$	$V_A = 2V_B$
b)	$v_A = \frac{1}{2}v_B$	$V_A = \frac{1}{2}V_B$
c)	$v_A = 2v_B$	$V_A = V_B$
d)	$v_A = 4v_B$	$V_B = V_A$

38. The adjacent figure shows a **wave source** on the surface of a lake. If a person throws a stone at point (x), the waves reaching the following regions in the lake will be the **shallowest** (الاقفل عمق) at



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

39. Two sound waves with frequencies **300 Hz** and **600 Hz** propagate in air. The ratio between their speeds equals

- a) 2 : 1 b) 1 : 2 c) 1 : 1 d) 1 : 4

40. The human ear can hear frequencies ranging between **20 Hz** and **2×10^4 Hz**.

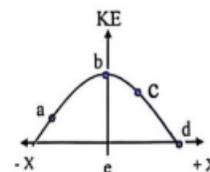
Therefore, the **shortest** and **longest wavelengths**, respectively, of the sounds that can be heard by humans are

(Given that the speed of sound in air = **340 m/s**)

- a) 0.06 m, 59 m b) 0.017 m, 17 m
c) 0.005 m, 0.05 m d) 6800 m, 6.8×10^6 m

41. The adjacent figure shows the relationship between **kinetic energy** and **displacement** for a body executing **simple harmonic motion**.

Therefore:

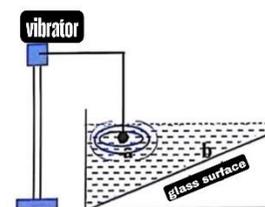


	Position of equilibrium of the body	The point at which the speed of the body is maximum	The point at which the acceleration of the body is maximum
a)	d	a	b
b)	d	d	e
c)	e	c	a
d)	e	b	d

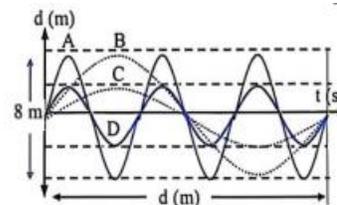
42. A **slanted glass plate** is placed in a **ripple tank** as shown in the figure.

If the **wave speed** at point (a) equals **1.5 m/s**, the **wavelength** at point (b) equals **2 cm**, and the **periodic time** equals **1.47×10^{-2} s**, then which of the following rows is **correct**?

	Wavelength at (a)	Speed at (b)	Frequency of the vibrator (ν)
a)	2.2 cm	1.36 m/s	68 Hz
b)	0.55 cm	0.72 m/s	75 Hz
c)	1.82 cm	1.65 m/s	61.8 Hz
d)	2.2 cm	0.72 m/s	68 Hz



43. The Four waves **A, B, C, and D** move in the **same medium** and travel a distance **d (m)** during the same time interval **t (s)** as shown in the figure.

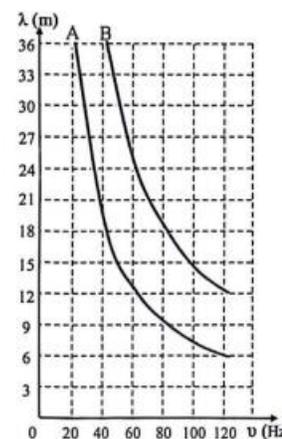


Which of the following choices correctly represents the **ratios** between?

	Amplitude of A : Amplitude of C	Frequency of A : Frequency of B	Speed of A : Speed of C
a)	1 : 2	1 : 3	1 : 3
b)	1 : 3	1 : 1	1 : 1
c)	2 : 1	3 : 1	1 : 1
d)	3 : 1	2 : 1	3 : 1

44. The adjacent figure shows the relationship between **wavelength** and **frequency** for several sources of the **same type of wave** in media **A** and **B**.

If the speed of the generated waves in **A** is (**V₁**) and these waves are transmitted to medium **B** with speed (**V₂**), then which of the following choices is correct?



	Wave speed	Ratio $\frac{v_a}{v_b}$	Periodic time
a)	Increases	2:1	Increases
b)	Decreases	1:1	Constant
c)	Decreases	2:1	Decreases
d)	Increases	1: 2	Constant

45. If The adjacent figure represents a **vibrating string in air** with frequency (**v**).

(i) The type of wave formed in the string is:

- a) Longitudinal b) Transverse c) Electromagnetic



(ii) As a result of the vibration of the string, the wave produced in air is:

- a) Longitudinal b) Transverse c) Electromagnetic

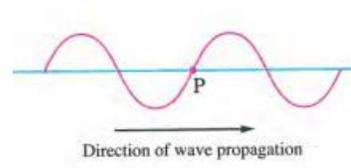
(iii) The frequency of the wave produced in air the frequency of the vibrating string.

- a) Greater than b) Less than c) Equal to

46. The opposite figure shows a **transverse mechanical wave** propagating in a medium **from left to right**.

So, **in which direction does particle P move at the shown instant?**

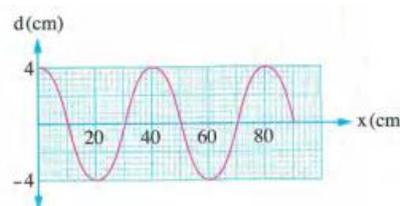
- a) Rightward b) Leftward c) Upward d) Downward



47. The opposite graph represents the relation between the **displacement (d)** of the medium particles through which a wave propagates and the **horizontal propagation distance (x)** of this wave.

If **one of the medium particles takes time t to have a displacement of 4 cm away from its equilibrium position**, then the **wave moves through the time t a distance of**

- a) 10 cm b) 20 cm c) 40 cm d) 80 cm



48. Two tones have **frequencies 680 Hz and 425 Hz** in air.

If the **wavelength of one of them is greater than the wavelength of the other wave by 30 cm**, then the **speed of sound in air** equals

- a) 320 m/s b) 330 m/s c) 340 m/s d) 544 m/s

49. A boy heard the **thunder 18.74998 s after seeing the lightning** produced in a thunderstorm that was at a **distance of 6 km away**.

So, the **speed of sound in air** was

(Given that: the speed of light in air = 3×10^8 m/s)

- a) 360 m/s b) 340 m/s c) 330 m/s d) 320 m/s