



PHYSICS

BOOKS - PEARSON IIT JEE

FOUNDATION

THE MECHANISM OF MACHINES

Example

1. A boy able to lift a bag containing books of 30 N placed at an end of the see-saw by

applying a force of 5 N at another end. Find the mechanical advantage of the see-saw.



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2. If mechanical advantage of an inclined plane is 3 and its height is 2 m, then what will be its length?



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3. A machine is operated by an effort of 50 N to lift a load of weight 100 N. Calculate MA



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4. An inclined plane of length 8 m is used to lift a load of 20 dynes, by applying an effort of 5 dyne . Find the height of the plane



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5. A crowbar of length 120 cm is used as a second - order lever to move a rock. If the load arm is 30 cm and the amount of force required to move the rock is 1000 N, find the minimum effort required to move the rock



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Test Your Concepts Very Short Answer Type Questions Fill In The Blanks

1. Work done by a machine equals to _____.



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2. A rod which is free to move around a point is called_____.



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3. See-saw is an example of _____ order lever.



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4. If the mechanical advantage of a lever is equal to 1, then the effort applied on it _____ the load.



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5. If the slope of an inclined plane is steeper, the effort required to push a load through it is _____.



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6. If MA of a simple machine is greater than 1, then effort arm is _____ than the load arm.



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7. For _____ order lever, mechanical advantage (MA) is always greater than 1.



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8. For a single movable pulley, MA is _____.





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9. Forceps are an example of _____ order lever.



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10. If mechanical advantages of two inclined planes A and B are in the ratio of 1 :3, the slope of A must be _____ than that of B.



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Test Your Concepts Very Short Answer Type Questions M C Q

1. If the effort arm of a lever is twice of its load arm, it is a ____.

- A. First-order lever
- B. Second-order lever
- C. Third-order lever
- D. 1 or 2

Answer: B





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2. Which of the following machines is used only to change the direction of input force?

- A. Inclined plane
- B. Single-fixed pulley
- C. Scissors
- D. Screw jack

Answer: B



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3. Which of the following is wrong?

A. I^{st} order lever : $MA > 1$

B. II^{nd} order lever : $MA > 1$

C. III^{rd} order lever : $Ma > 1$

D. Single - fixed pulley : $Ma = 1$

Answer: C



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4. Which of the following planes cannot be used to push load to a certain height?

A. A plane of slope 2

B. A plane of slope ∞

C. A plane of slope 0

D. Both (b) and (c)

Answer: D



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5. If load is between the fulcrum and effort of a lever, it is called ____ order lever.

A. I^{st}

B. II^{nd}

C. III^{rd}

D. IV^{th}

Answer: B



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6. Efficiency of an ideal machine is _____.

A. 0 %

B. 50 %

C. 90 %

D. 100 %

Answer: D



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7. Which of the following is an example of wedge?

A. Axe

B. Needle

C. Knife

D. All of the above

Answer: D



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8. Ghat road is an example of

A. Wedge

B. Inclined plane

C. Block of pulleys

D. None of these

Answer: B



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9. Which of these is not a wheel and axle

A. Screw driver

B. Tap

C. Screw

D. Door knobs

Answer: C



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10. Regular oiling of parts increases their

A. Output work

B. Efficiency

C. Mechanical advantage

D. None of these

Answer: B



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Test Your Concepts Short Answer Type Questions

1. Define machine.



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2. Define effort.



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3. Define load.



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4. Define mechanical advantage.



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5. Write a short note on maintenance of machinery.



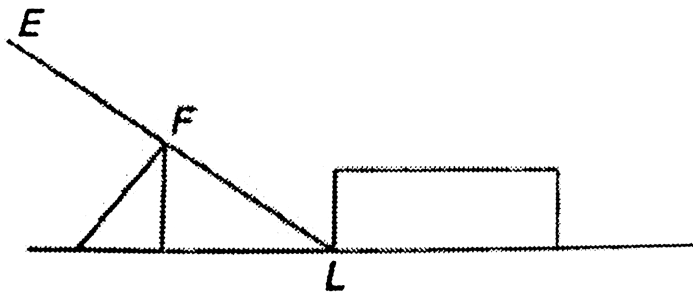
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6. If an effort of 10 N is applied on a single-fixed pulley to lift a weight of 10 N, then find out its mechanical advantage.



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7. If an inclined plane of length 2 m is used to lift a load of 20 N to a height of 1 m, find the effort required to lift the load to that height using inclined plane.



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8. A crowbar of length 1 m is used to displace a body . Find its mechanical advantage, if the load arm is 0.5 m



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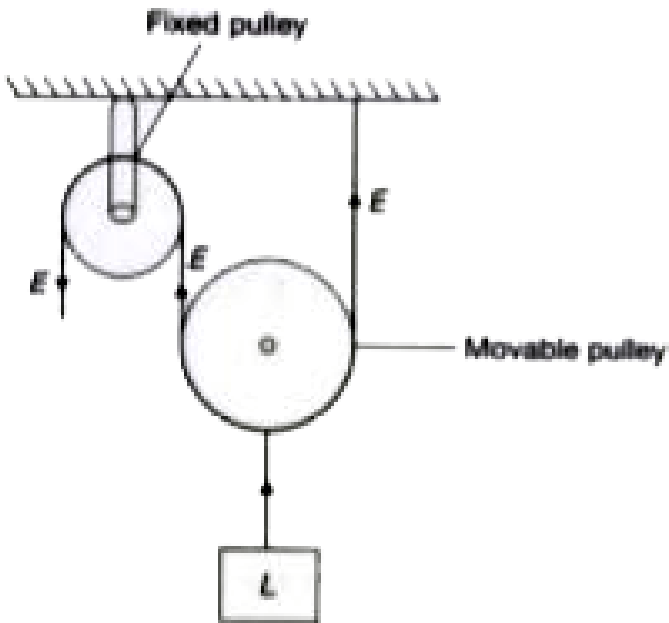
9. A see-saw of length 2 m is pivoted at 50 cm from one end in a public park. What is the effort applied at the near end to the fulcrum to lift a load of 150 N at the far end to fulcrum?





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10. Find the mechanical advantage of the below figure :



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11. Ram used a crowbar of length 1.5 m as a II^{nd} order lever to displace a heavy sphere placed on the horizontal surface. If the crowbar applies a force of 240 N on the sphere at a distance of 100 cm from effort, then find the minimum effort applied by Ram to displace it.



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12. A tailor purchases a scissors of length 25 cm through online shopping. He sent a feedback to the manufacture saying 'I cannot

cut the Jeans cloth even if I apply may maximum force 83.3 N on it , so please modify it without changing its length so that I can cut the Jeans cloth at least with my maximum effort ' If you are the manufacturer how can you modify the scissors as per the feed - back given by the tailor Initially fulcrum is exactly midway between two ends of scissor and the minimum force required to cut the jeans cloth is 500 N. The position of the load should always be at 7.5 from the free end of load arm



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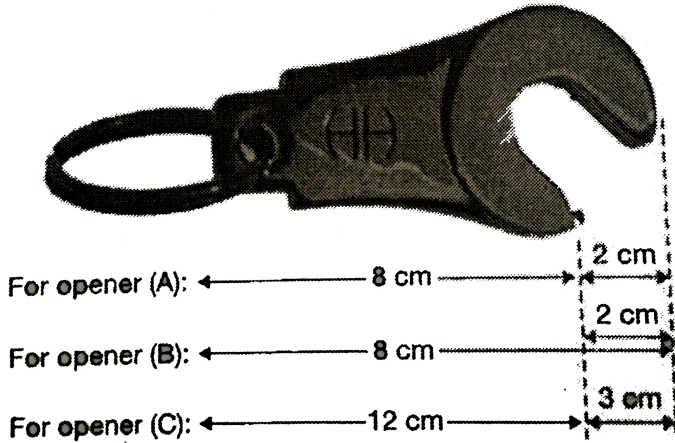
13. Roopa observed that her mother is using a cutting plier instead of fire tongs to hold a hot container and she prevented her from doing so. Why?



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14. To open the lid of bottle, 50 N force is needed, Siri wanted to open the lid with her maximum effort of 10 N, which of the following

openers is suitable for doing it?



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15. Hari and Vamshi constructed houses adjacent to each other, in such a way that the ground floors of both the houses are of height 1 m each from the level of the road. Vamshi

built an inclined plane in front of his house so that its length is 50% more than of Hari's house Find the ratio of the efforts required to lift the same load to the ground floor of both houses



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Concept Application

1. Hari is studying in 6th standard and is interested in science related experiments.

While reading simple machines topic from his text book, he started wondering as to which lever a pen belongs to in its writing position? The length of the pen he is using is 14 cm and he holds it at distance of 4 cm from its nib. If the force applied by Hari to write is 0.02 N, the mechanical advantage of the pen is _____ and it is acting as a _____ order lever.

A. 5, second

B. 0.25, first

C. 2.5, third

D. 0.243 third

Answer: D



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2. A nut is placed in a nut cracker at 5 cm from the fixed end. If the force experienced by the nut is 100 N when a force of 20 N is applied at the free end of the nut cracker, find the length of the nut cracker.

A. 5

B. 25

C. 15

D. 20

Answer: B



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3. Anil has a two-wheeler that weighs 120 kg. After completing his work, he used to park his vehicle in the regular parking place which is in connected to the ground with a ramp of

inclination 45° . If the length of ramp is 1 m, then calculate the work done by Anil to park the vehicle against gravity. ($g = 10\text{ms}^{-2}$)

A. 10500 J

B. 1005 J

C. 1050 J

D. 1500 J

Answer: C



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4. Krishna had parked his two-wheeler at "no parking" place as he did not find any board regarding the notice NO PARKING. After some time, the traffic police took away his bike to a nearby police station, by lifting it with a rope attached to a pulley arrangement. If the mass of the bike is 150 kg, the what is its weight in dynes?

A. 15×10^7 dynes

B. 1500 dynes

C. 150 dynes

D. 15 dynes

Answer: A



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5. A farmer was cutting mangoes from a tree with a long stick of length 2 m. He cut almost all mangoes at the lower branches of the tree and then he aimed to cut the mangoes at higher branches of it. To do this he attached another stick to the top of the first stick so

that the overall length increases by 1 m. If the distance between his hands position is the same as before at 40 cm and weight of each mango is 5 N, then calculate the change in mechanical advantage of stick to do this, for the same effort of 20 N

- A. Mechanical advantage increases by 0.26
- B. Mechanical advantage decreases by 0.0066
- C. Mechanical increases by 0.0066
- D. Mechanical advantage decreases by 1.87

Answer: B



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Assessment Test Test I

1. Find the MA of first-order lever of length 50 cm, if the fulcrum is exactly midway between the effort and load.



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2. Find the ratio of the load arm to that of the effort arm of a second-order lever if its mechanical advantage is 5.



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3. Explain why, a single-fixed pulley is used to lift a load even if its MA is equal to 1?



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4. How can you increase the mechanical advantage of a see-saw without their changing its length?



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5. How can use third order levers as machines even though their MA is less than one?



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6. If you are using a Screwdriver to twist out a screw, you are actually using 2 simple machines, What are they



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7. A rod attached to the centre of a wheel is called _____



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8. What is the efficiency of a simple machine ?



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9. A crowbar is of 150 cm length. Its fulcrum is at a distance of 50 cm from the load. Find out the mechanical advantage.



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10. Give two examples where we use wedges as simple machines.



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11. Although, mechanical advantage is less than 1 for class-three levers, we still use them. Give reason.



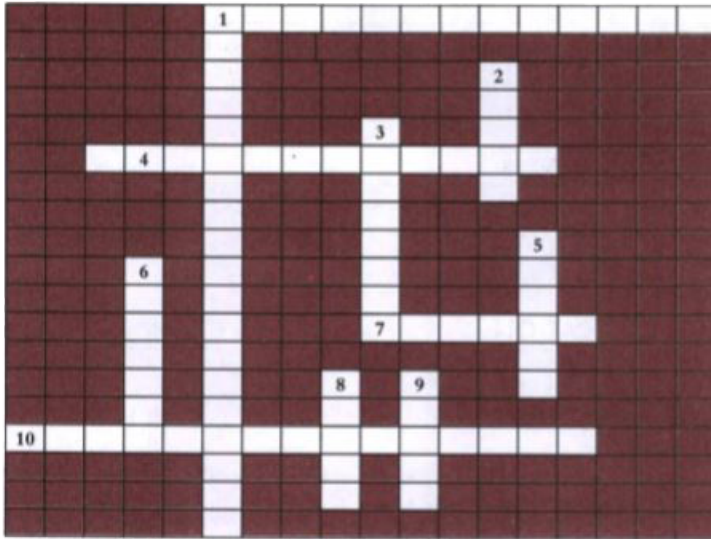
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12. If the mechanical advantage of a lever is 2.5, what will be the effort you need to apply to lift a load of 50 N?



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Crossword



1.

Across

1. Pulley whose axis of rotation is not fixed (2

Words)

4. This is a second - order lever used for a fruit

cutter

7. Greater the number of pulleys, ____ is the

force needed to lift heavy loads

10. Scissors are an example of _____ (2 Words)

Down

1. Greater the _____ the smaller the effort required to overcome a certain load (2 Words)

2. Inclined plane wound around

3. Block and tackle means more number of _____

5. This simple machine changes the direction of applied force

6. This can be uses both as first and second - order lever

8. Leading edge shape of a speed boat

9. Tap works on the principle of _____



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