

NAME
SCHOOL

INDEX NUMBER
DATE

WORK, ENERGY POWER AND MACHINES

1. 1995 Q2 P1

Figure 1 shows a worker ready to lift a load wheelbarrow



Use the figure to answer questions 2 and 3

Indicate and label on the diagram three forces acting on the wheelbarrow when the person is just about to lift the handlebars (2 marks)

2. 1995 Q3 P1

Suppose the handle bars of the wheelbarrow in question 2 were extended, which force(s) would change and how? (2 marks)

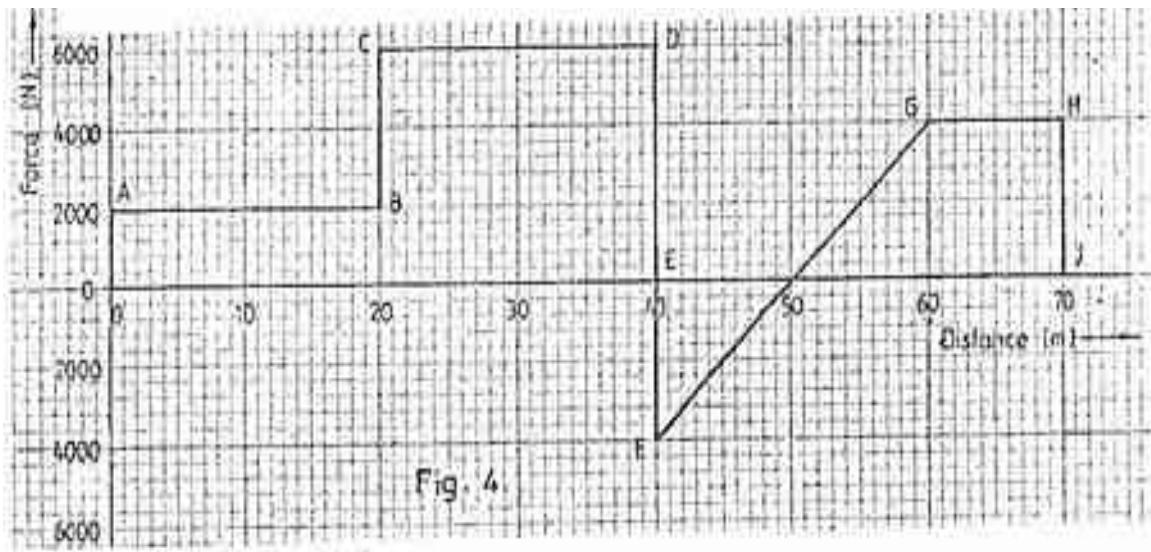
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3. 1996 Q16 P1

Sketch in the space provided below, a labelled diagram to show how an arrangement of a single pulley may be used to provide a mechanical advantage of 2 (2 marks)

4. 1997 Q4 P2

Figure 4 shows a force- distance graph for a car being towed on a horizontal ground



(a) Calculate the total work done

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(b) If the velocity just before reaching point D is 0.6ms^{-1} , calculate the power developed by the agent providing the force at this point.

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(c) An electric pump can raise water from a low level reservoir to the higher – level reservoir at the rate of 3.0×10^5 kg per hour. The vertical height of the water raised 360m. If the rate of energy loss in form of heat is 200KW, determine the efficiency of the pump

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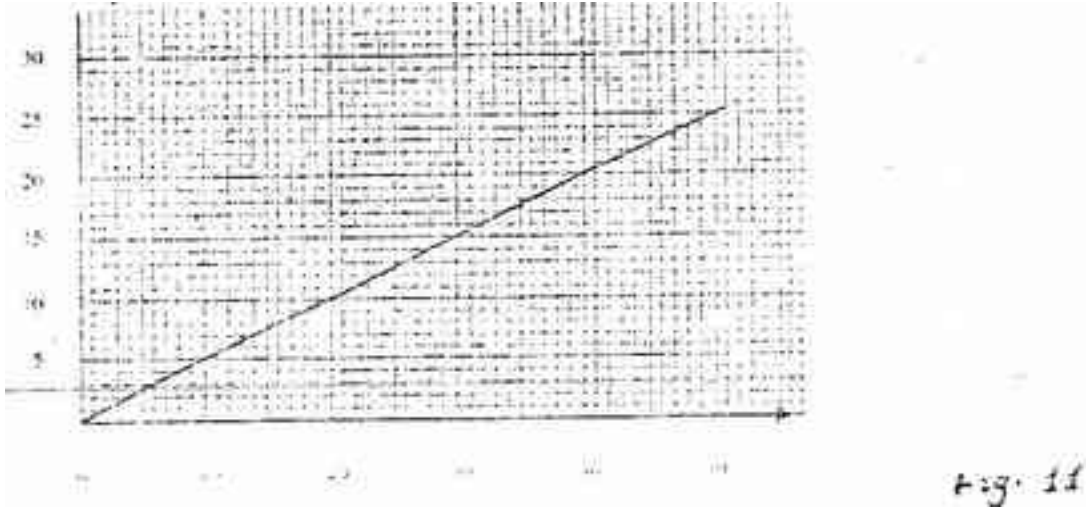
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5. 1999 Q14 P1

Figure 11 is a graph which shows how the vertical height through which a machine raises a mass 20kg varies with time.



Determine the power output of the machine after 40 seconds.

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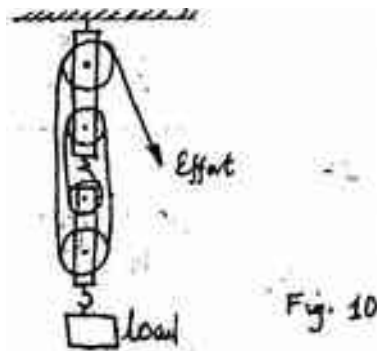
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6. 2000 Q15 P1

Fig 10 shows a pulley system being used to raise a load. Use the information given in the figure to answer the questions 15 and 16.



Determine the velocity ratio (VR) of the system.

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7. **2001 Q15 P1**

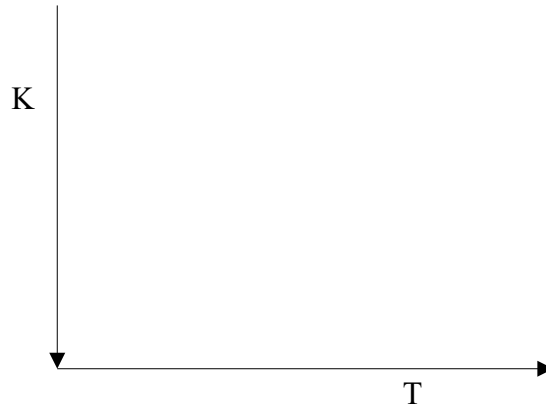
A certain machine raises 2.0 tonnes of water through 22 metres. If the efficiency of the machine is 80%, how much work is done on the machine. (Acceleration due to gravity $g = 10\text{ms}^{-2}$)

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8. **2003 Q26 P1**

Two identical stones A and B are released from the same height above the ground B fall through air while A falls through water.

Figure 14.



On the axes provided in Figure 14, sketch the graphs of kinetic energy (KE) against time (t)

9. **2003 Q2 P2**

a) A crane lifts a load of 200kg through a vertical distance of 3.0m in 6 seconds. Determine:

(i) Work done

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(ii) Power development by the crane.

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(iii) Efficiency of the crane given that it is operated by an electric motor rated 12.5kW.

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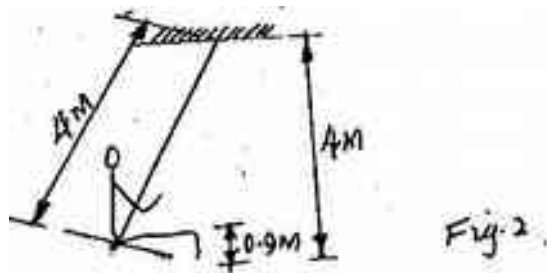
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(b) A child of mass 20kg sits on a swing of length 4m and swings through a vertical height of 0.9m as shown in figure 2..



Determine:

(i) Speed of the child when passing through the lowest point.

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(ii) Force exerted on the child by the seat of swing when passing through the lowest point. (14 marks)

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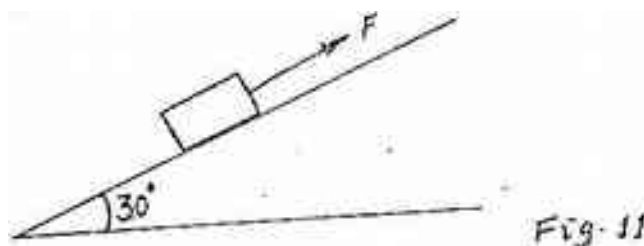
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10. 2004 Q18 P1

A body of mass 60kg is pulled at a uniform velocity up smooth inclined surface as shown in Figure 11



If the distance moves along the incline is 4.0m, determine work done by the force F.

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11. 2005 Q15 P1

A certain machine uses an effort of 400N to raise a load of 600N. If the efficiency of the machine is 75%, determine its velocity ratio. (3 marks)

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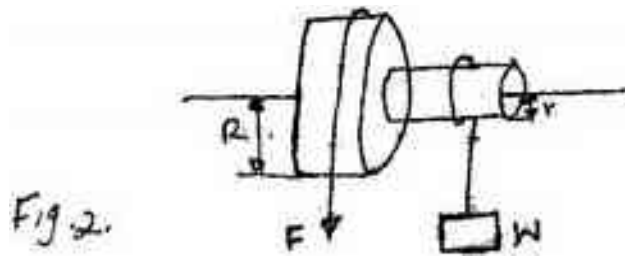
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12. 2005 Q2 P2

a) Fig 2. Shows a wheel and axle being used to raise a load W by applying an effort F The radius of the large wheel is R and of the small wheel r as shown.



(i) Shows that the velocity ratio (V.R) of this machine is given by R/r (3 marks)

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(ii) Given that $r = 5\text{cm}$, $R = 8\text{cm}$, determine effort required to raise a load of 20N if the efficiency of the machine is 80% (4 marks)

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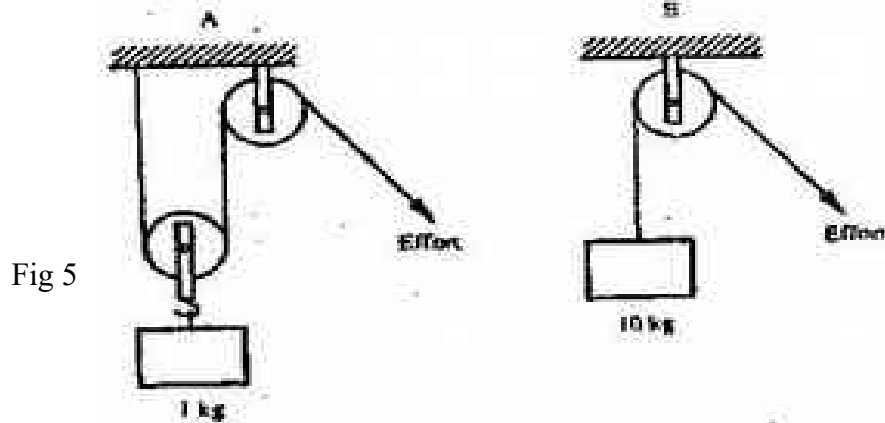
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- (iii) It is observed that the efficiency of the machine increases when it is used to lift large loads. Give a reason for this. (1 mark)

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13. 2006 Q7 P1

Figure 5 shows two pulleys systems being used to raise different loads. The pulleys are identical.



State one reason why system B may have a higher efficiency than system A. (1 mark)

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14. 2008 Q18 P1

- (a) Define the term velocity ratio of a machine. (1 mark)

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- (b) Fig. 12 shows part of a hydraulic press. The plunger is the position where effort is applied while the Ram piston is the position where load is applied. The plunger has cross-section area, $a \text{ m}^2$ while the Ram piston has cross-section area, $A \text{ m}^2$.

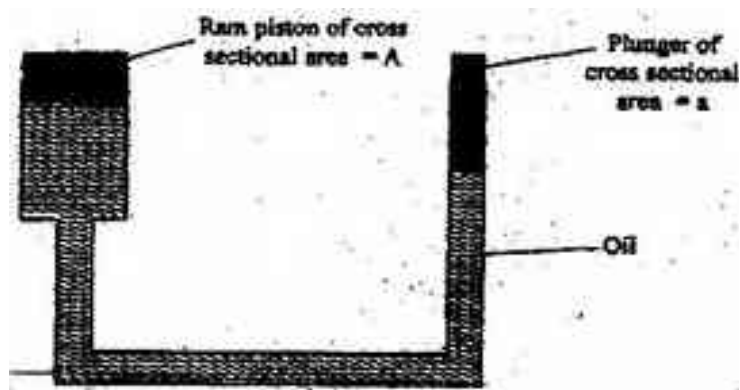


Figure 12

When the plunger moves down a distance d the Ram piston moves up a distance D .

- (i) State the property of liquid pressure on which the working of the hydraulic press works. (1 mark)

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- (ii) Derive an expression for the velocity ratio (V.R) in terms of A and a . (4 marks)

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- c) A machine of velocity ratio 45, overcomes a load of $4.5 \times 10^3\text{N}$ when an effort of 135N is applied.

Determine:

- (i) The mechanical advantage of the machine; (2 marks)

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- (ii) Efficiency of the machine; (2 marks)

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(iii) The percentage of the work that goes to waste. (1 mark)

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15. 2009 Q16 P1

(a) Define the efficiency of a machine. (1 mark)

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(b) Figure 9 shows a drum of mass 90kg being rolled up a plane inclined at 25° to the horizontal. The force F applied is 420N and the distance moved by the drum along the plane is 5.2M



Figure 9

Determine:

(i) Work done by the effort; (3 marks)

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(ii) The Work done in raising the drum; (3 marks)

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(iii) The efficiency of the inclined plane as a machine. (2 marks)

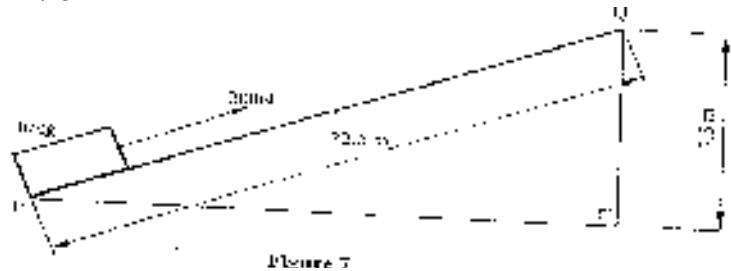
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16. 2010 Q15 P1

a) A cyclist initially at rest moved down a hill without pedalling. He applied brakes and eventually stopped. State the energy changes as the cyclist moved down the hill. (1 mark)

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b) Figure 7 shows a mass of 30kg being pulled from point P to point Q with a force of 200N parallel to an inclined plane. The distance between P and Q is 22.5m. In being moved from P to Q the mass is raised through a vertical height of 7.5m.



i) Determine the work done:
 I by the force (2 marks)

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II on the mass (2 marks)

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ii) Determine the efficiency of the inclined plane. (2 marks)

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c) Suggest one method of improving the efficiency of an inclined plane.(1 mark)

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17. 2011 Q15 P1

Figure 10 shows a simple pendulum of length 80cm. The pendulum bob whose mass is 50g oscillates between points A and B, through its rest position C. A and B are both 10cm higher than C.

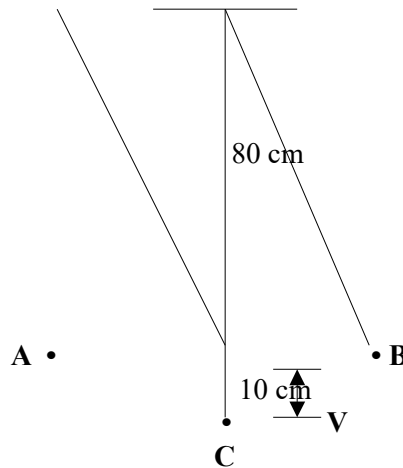


Fig 10

- a) i) Indicate with an arrow, on the path ACB the direction of the greatest velocity of the bob as it moves from A and B. (1 mark)
 ii) State the form of energy possessed by the pendulum bob at point A.

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- b) Determine
 i) The velocity of the bob at point C. (3 marks)

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- ii) The tension in the string as the bob passes point C. (3 marks)
 (Take acceleration due to gravity $g=10\text{m/s}^2$)

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- c) After sometime, the pendulum comes to rest at point C. State what happens to the energy it initially possessed. (1 mark)

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18. 2012 Q12 P1

State two reasons why the efficiency of pulley system is always less than 100% (2 marks)

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