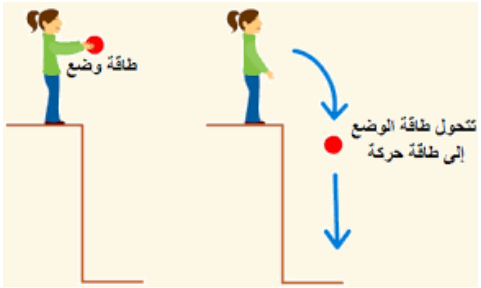
فيزياء الحادي عشر متقدم



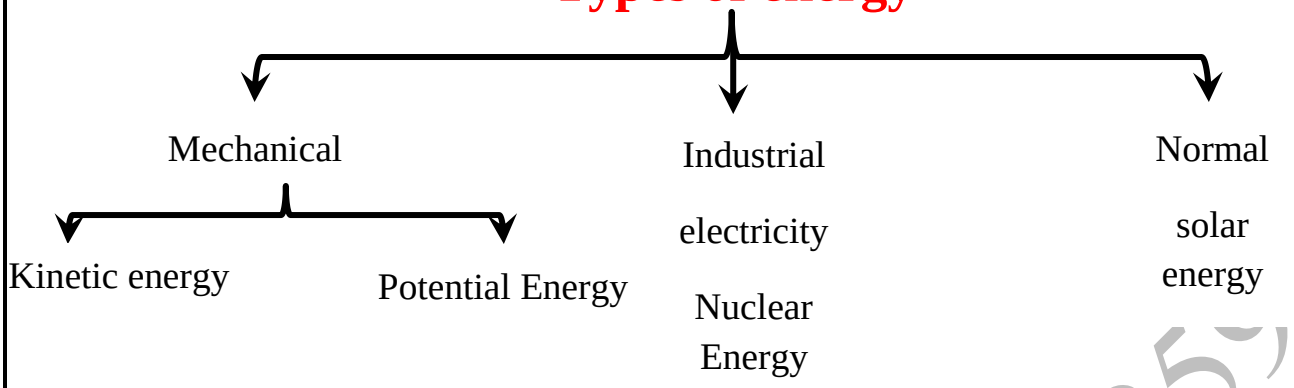
KINETIC ENERGY, WORK AND POWER

إعداد

الأستاذ / مجدي عوض

Energy

Types of energy



Work

Definition of work:

Is the work done by a force to move an object in the direction of its impact

The standard output of the power vector in the displacement vector

Calcolat Work :

$$W = \vec{F}\,\vec{d}\cos\theta$$

Angle(θ)The angle between the force direction and the displacement direction

Some remarks on the Work :

① If the force is perpendicular to the body, the work is equal (zero)

② If the strength of an object is affected and not moved, the work is equal (zero)

③ If someone carries an object and moves it, it does not make a job because the gravity effect differs from the person's movement

④ When the body moves at constant speed, the work is equal (zero)

⑤ The job may be negative. Such as the resulting friction force

⑥ If an object is affected by several forces, the total work is equal to the forced sum of the work produced by each force

⑦ The value of the job can be determined from the charts. This calculates the area below the curve determined for the relationship between force and displacement.

Energy measurement units:

① Joll and symbolized by the symbol (J)

② electron volts

$$1\ eV = 1.602 \times 10^{-19} J$$

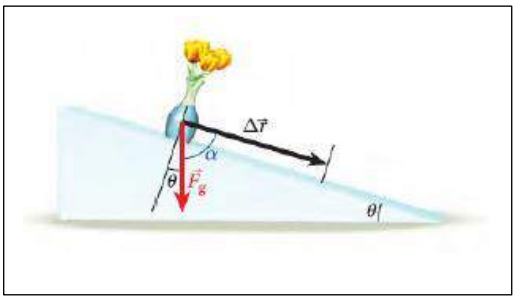
③ caloric symbolized by the symbol (cal)

$$1\ cal = 4186\ J$$

④ megatons and symbolized by the symbol (M t)

$$1M\ t = 4.18 \times 10^{15}\ J$$

Work of constant Force :



When an object slides as shown in the figure next door. It slides under the influence of the horizontal vehicle of gravity. Which can be calculated as acceleration of the following law.

$$a = g \sin\theta = g\ cos\alpha$$

Where ($\alpha = 90 - \theta$)

Note:

① When drawing a graphic relationship between power and distance. The space enclosed below the curve is equal to the amount of work

② In the case of moving objects with a speed of (a), the force can be found from Newton's second law

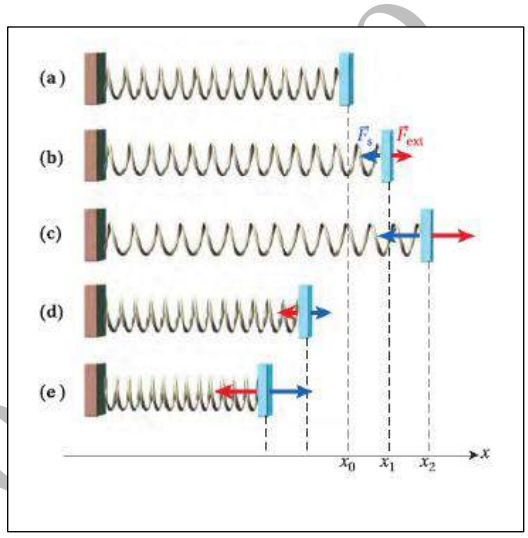
$$F_x(x) = m\ a$$

Work done by a variable force:

Assuming that the force influencing an object is variable, the work done can be derived from the following equation

$$W = \int_{x_o}^{x} F_x(\acute{x}) \dot{d}\acute{x}$$

Work done by spring force:



When a force is exerted on the spring, its length may increase if the force is a force of tension. Or decreases its length if the force is a compressive force.

The amount of force influencing the spring can be calculated from the following law

$$\overrightarrow{F_s} = -k(\vec{X} - \overrightarrow{X_o})$$

And that of the Hawk Act. Work on the spring can also be calculated from the following law

$$W_s = -\frac{1}{2} k X^2$$

Note:

The work on the spring shall be negative if the spring is affected by a tight force. The work on the spring is also positive when it is affected by pressure. Because in case of compression, the value of Xo is greater than the value of X,

Problems on the Work

1. A sailor takes a distance of (40 m) to the north using a rope at an angle (25 ^{o}) above the horizontal axis. How much work does the sailors do on the boat if it has a 255 N force in the rope

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2- The amount of work carried out on vacuum cleaner takes a distance of (4 m) with a force of (60 N) angle (40 ^{o}).

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3. The maximum height of a mass ball (2.5 kg) is vertically shot up. If the work carried by the force of gravity from the moment of tossing until reaching the maximum height equals (- 80 J)

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4. A 120 kg mass factor (3 m) shall be pushed at a fixed speed up to the top of a surface tilted horizontally at an angle of (30o) if the friction strength between the surface of the box and the oblique surface (30 N).

A) Calculate the work of the worker on the fund

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B) Calculate the work done by the friction force

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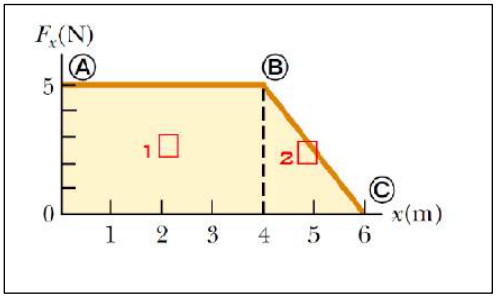
5 - Force to the positive (X) axis on the body. If the amount of force changes as in the figure shown . Find the amount of work done by the force to take a distance of (6 m)



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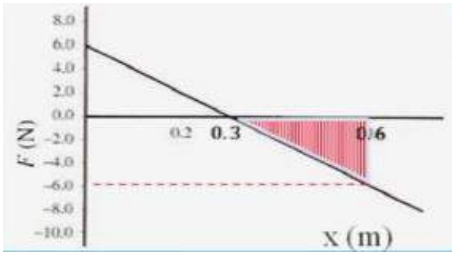
6 - affect the strength of the body. The graph below shows the relationship between the force and the distance traveled. From the drawing, find the total amount of work done



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7. The Taliban together make a force of (830 N) to drive a car (40 m)

A) How much work the Taliban are doing

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B) If their power multiplies, how much distance will the car move when doing the same amount of work

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8. A rock climber carries an 8 kg backpack when climbing a rocky slope. After (40 min) the climber reached a height (8.6 m) from the starting point

A) How much work the climber has done on the back bag

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B) If the weight of the climber (650 N) is the total amount of work done to reach the same point

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9. Two persons lift up a heavy box (15 m) and use two ropes, each making a 15 ° angle with the vertical axis. The two men exert 225 Ns of work.

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10. A passenger carries a travel bag weighing 215 N to the top of the ladder. The displacement is 4.2 m vertically and 4.6 m horizontally,

A) how much work the passenger has done on the travel bag; With reasoning

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B) The passenger carried the same travel bag again and took down the stairs themselves. How much work did the passenger do on the bag?

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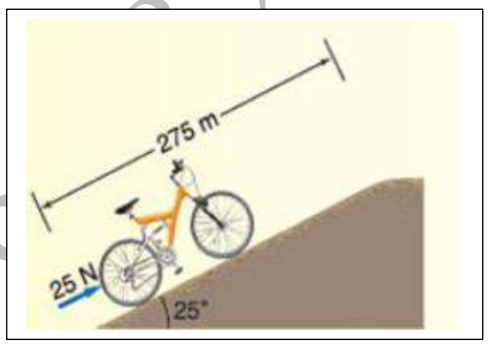
11. A cyclist who drives a 13 kg bicycle to a steep hill top (25 o) and the length of the road (275 m) as shown in the adjacent figure. The passenger drives the bike in a parallel direction to the road with a force of 25 N



A) The amount of work done by the passenger on the bike

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B) How much work gravity does on the bicycle

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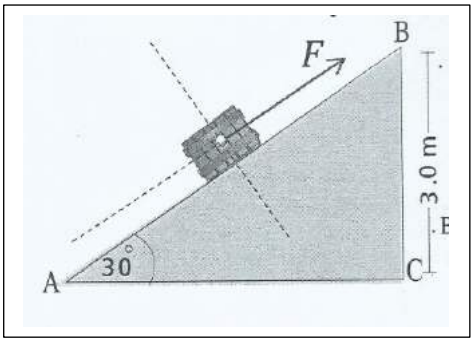
12. A weight box (90 N) in the adjacent shape shall be pushed to the highest of a 3 m height with a force of 100 N.



A) Total work to move the box from the bottom of surface (A) to (B)

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B) the work to move the box vertically from the bottom point (C) to point (B)

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C) Compare the work done in both cases

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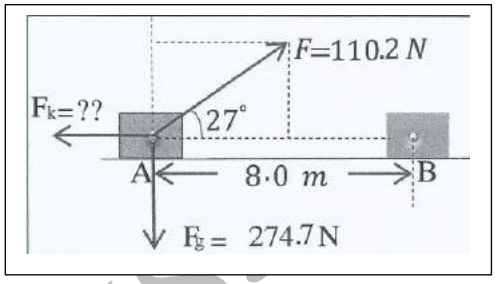
13 - Force (F) in the body shown side. Move horizontally with a fixed wheel (2 m / s ^{2}) between the two points (A and B) on the coarse surface. Calculate both:



A) The coefficient of friction between the surface and the body.

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B) the work done by each influential force on the object

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C) Total work done in moving the object

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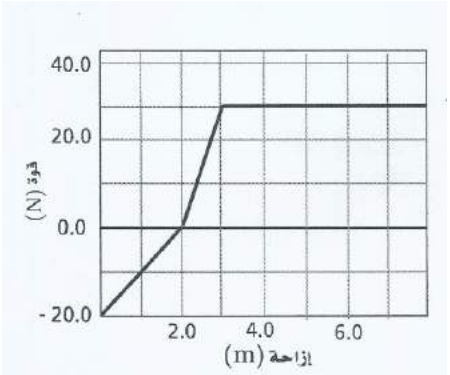
14. The graph below shows the force and displacement curve of an object pull. Calculate the work to pull the body distance (70 m)



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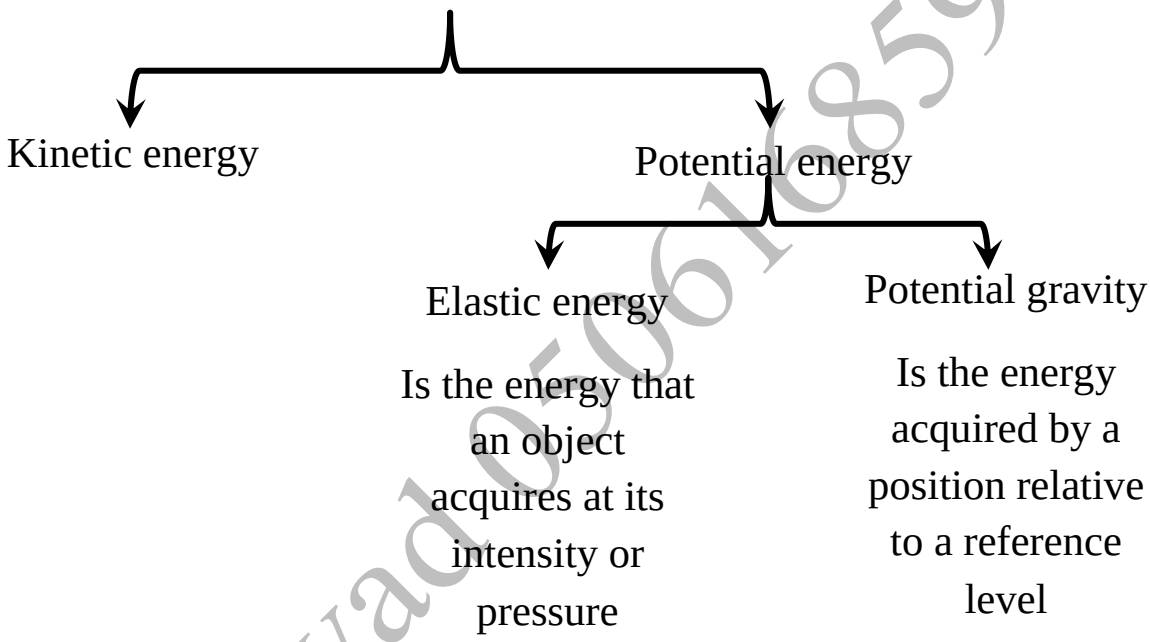
Energy

Energy:

Ability to make a Work .

Therefore, we note that the units of energy measurement are the same units of measurement of work (Jul) symbolized by the symbol (J)

Types of energy



First: kinetic energy:

Is the energy that the body acquires as a result of its movement

Law of calculating Kinetic energy:

$$KE = \frac{1}{2} m \vartheta^2$$

speed

Second: potential energy :

Is the energy acquired by a position relative to a reference level

Law of calculating potential energy and work :

$$PE = m\ g\ h$$

Height

From the definition of energy it can be concluded that the work involved in raising the body is equal

$$W = -m\ g\ h$$

The gravitational effect (object fall) is positive

Theory of work - Energy:

Work on a system equals the change in system energy

Work — Change in energy

$$w = \Delta E$$

Calculation of work in the case of the use of pulleys:

We can see that the suspended box in case (b) has a distance of (r_2) from the situation in case (a). But the tensile force (T_1) has a distance of (r_1) where ($r_2 = 1/2\ r_1$) and we note that the box is affected by a tensile force (T_2). That is, the force acting ($T_2 = mg$). But if we notice the drawing well, we find that the box is suspended in a moving wheel. We can therefore work between the actual tensile strength (T_1 and T_2) as we studied in the first semester ($T_1 = 1/2\ T_2$).

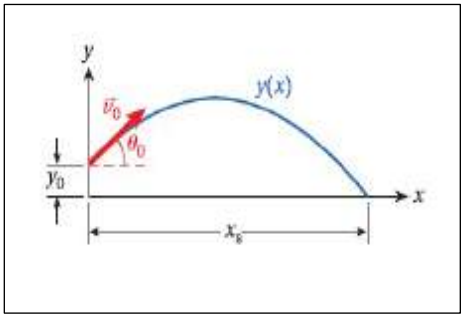
To find the amount of work done in lifting a body using a moving roller, use the following law

In the case of calculating the work done by the use of force (T_2) the following law is used

$$W_2 = m\ g\ r_2$$

In the case of calculating the work of the basic force (T_1), the following law shall be used:

$$W_1 = \frac{1}{2}\ m\ g\ r_1$$



From the above we note that ($W_1 = W_2$)

Calculation of work in the case of projectiles (throwing ball) :

Of the Act on the calculation of kinetic energy

$$KE = \frac{1}{2} m \vartheta^2$$

Since we do not know the speed with which the ball was launched. As the ball sprang from the height of the surface of the ground capacity (y_0), it must be found the initial speed, which kicked the ball of the following law

$$\vartheta_o^2 = \frac{x_s^2 \, g}{2 \cos^2 \theta_o \, (y_o + x_s \tan \theta_o)}$$

After calculating the initial velocity can apply the law of energy and find the amount of energy movement of the ball

Power

Power :

Work shift in time unit

Rate of change in energy for time

Laws of Power calculation:

Power — Time

$$P = \frac{W}{t}$$

Power — Change in energy — Time

$$P = \frac{\Delta E}{t}$$

Power — Speed — Force

$$P = \vec{F} \, \vec{\vartheta}$$

$$P = \frac{dW}{dt}$$

Power unit:

The unit is called watts and is denoted by the symbol w (w)

Other capacity measurement units are:

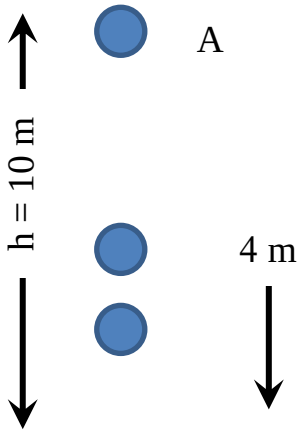
① The kilowatt hour is symbolized by the symbol (KWh)

$$1\ kWh = 1000\ W\ \times 3600s = 3.6 \times 10^6\ J = 3.6\ MJ$$

② The horse symbolized by the symbol (hp)

1 hp = 746 W

Power , work, energy



1 - Drop the body mass (2 kg) from point (A) as in the figure next door. Calculate the work done by gravity on this body

A) When the body reaches point B,

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B) When the body reaches point (C)

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2 - A horizontal force on the body of the movement of a distance of (50 m) on a smooth horizontal surface and its velocity of 50 m / s. If the amount of movement energy acquired by the body (1600 J)

A) The amount of force affecting the body

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B) The strength of this force during the period of its effect

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3. The body of a weight (190 N) slips from the top of a rough sloping surface - friction coefficient (0.4) down to a distance of 10 m. If the angle of the slope of level (25 O)

A) the work done by each influential force on the body.

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B) Total work done in moving the object

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C) Object speed when reaching the bottom of the surface

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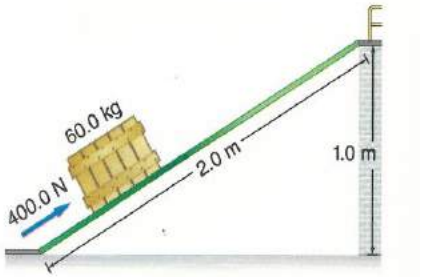
4. A person push a box of mass (60 kg) to a high diagonal level (2 m) connected to a horizontal platform (1 m) above the ground level as shown in the adjacent shape. A force of (400 N) is required to affect a direction equal to the tilt level of the fund pushing up at a constant speed



A) How much work a person has done to push the fund to the highest level.

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B) How much work a person does if the box is lifted vertically up from the surface of the earth to the platform

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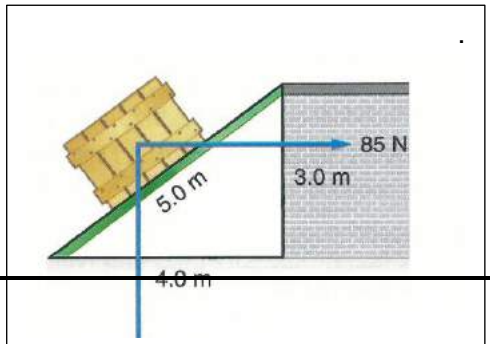
5. A weighing unit (93 N) shall be pushed to the highest of the diagonal, if the horizontal push is



equal to the surface of the earth as shown in the adjacent shape.

A) If the factor has a force of 85 N, the amount of work

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B) How much work gravity does

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C) If the motor friction coefficient (0.2) is the amount of work done by the friction force

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6 - The towing of a box across horizontal land at a constant speed requires a horizontal force of 805 N. If the box is connected with a rope tilted at a horizontal angle (32 o)

A) Find amount of force that affects the cord

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B) Find work is done on the box when you move a distance (22 m)

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C) If the box moves within (8 s) what is the amount of power produced

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7 - The maximum load of a 1000 kg elevator is 800 kg. It is subjected to a constant friction force of 10 3 N × 4, which is the maximum in kilowatts of capacity that the engine must carry in order to move at full load speed (3 m / s)

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8. A person of mass (50 kg) climbs a vertical strand for a distance of 5 m at a constant speed. How much time is needed if its capacity is 200 w ? Find work does a person do ?

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9- The length of the stair (5 m) and the mass (22 kg) center of gravity is (2 m) from the bottom. The ladder holds a mass of 5 kg at the upper end. Calculate the work required to lift the ladder from a horizontal position on the ground to a vertical position.

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10. Calculate the effective work of a pump that discharges ($2\ m^3$) of linseed oil into a tank that rises (15 m) above the oil-containing plateau. Note that the density of linseed oil ($941\ kg / m^3$)

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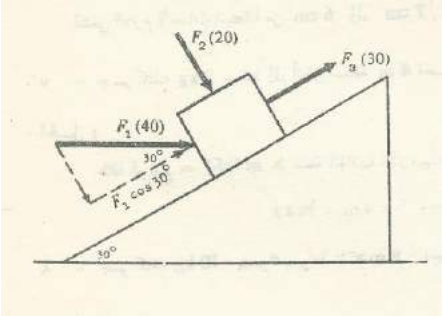
11 - An object that moves up above a level as shown in the adjacent shape. Under the influence of three forces illustrated by drawing. Calculate the value of the work done for each power separately when the body moves a distance of 10 m above the level.



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12 - body mass (5 kg) falls free down from the height (3 m) Calculate the energy of his movement when it hits the ground. Prove that it equals the energy placed before falling

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13 - Extruded rocket (20 kg) moving at a speed (600 m / s) The extruder gained its speed as it passed through a pipe length (3 m). Calculate the anti-ejective medium when starting.

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14 - stone thrown forward on the surface of the earth at a speed of (28 m / s) If the coefficient of friction between the movement of stone and earth is (0.25) Calculate the time required by the stone and the distance it breaks before stopping.

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15. Calculate the mass of the potential mass (4.5 k w) to be measured at a speed of 7 m / s on a flat road. If the friction coefficient between this block and the road is (0.2).

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16. Calculate the average capacity to lift a cylinder (140 kg) to the highest distance (15 m) in 1 minute time

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17- 30 k w (30 kW) machine on a flat road at a speed of 54 km / h Calculate total air resistance and friction controlled by machine

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18. Calculate the value of the mass that all of its capacity (30 k w) can drive on a flat road at a speed of 15 m / s if the friction coefficient between the mass and the road (0.15)

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