

Al Shawamekh Cycle 2 & 3 School for Girls Revision sheet 1- Term 3

Grade -9 A

Physics

Ms. Asitha Cleatus

Chapter 8. Work, energy and machines

Section1: Work, energy

Work: Work is the transfer of energy that occurs when a force (F) is applied through a displacement (d).

When force is parallel to displacement

✓ **Work= Force x Displacement**

$$W = F \times d$$

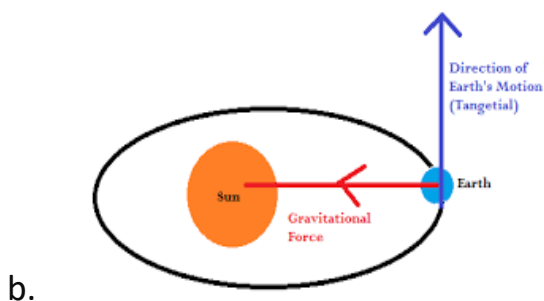
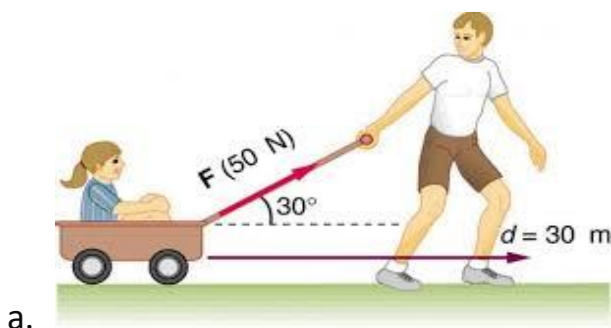
✓ **Unit of work : Joule (J) or the newton-meter (N.m)**

WORK

Work is equal to the product of the magnitude of the force and magnitude of displacement times the cosine of the angle between them.

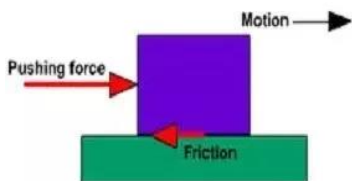
$$W = Fd \cos \theta$$

1. Calculate the work done in the following cases



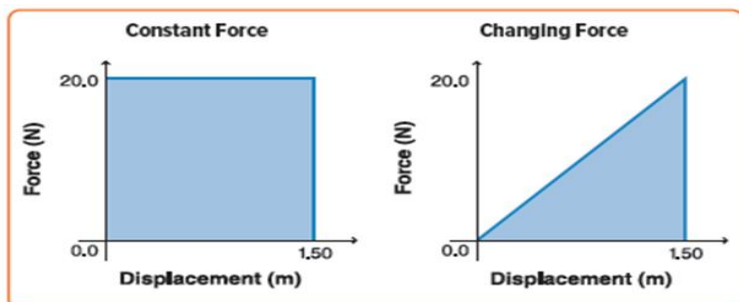
Al Shawamekh Cycle 2 & 3 School for Girls

- c. work done by friction if its displacement is 2m and frictional force is 3 N



2. Ahmed uses a force of 25 Newtons to lift his grocery bag while doing 50 Joules of work. How far did he lift the grocery bags?
3. Ahmed lifts his grocery bag of 10kg vertically without an acceleration through 1m. How much work is being done by him?
4. A force of 70 N acts on an object at 60° to the horizontal and as a result, the object is displaced horizontally through a displacement of 23 m. Determine the work done on the object.

The area under a force-displacement graph is equal to the work.

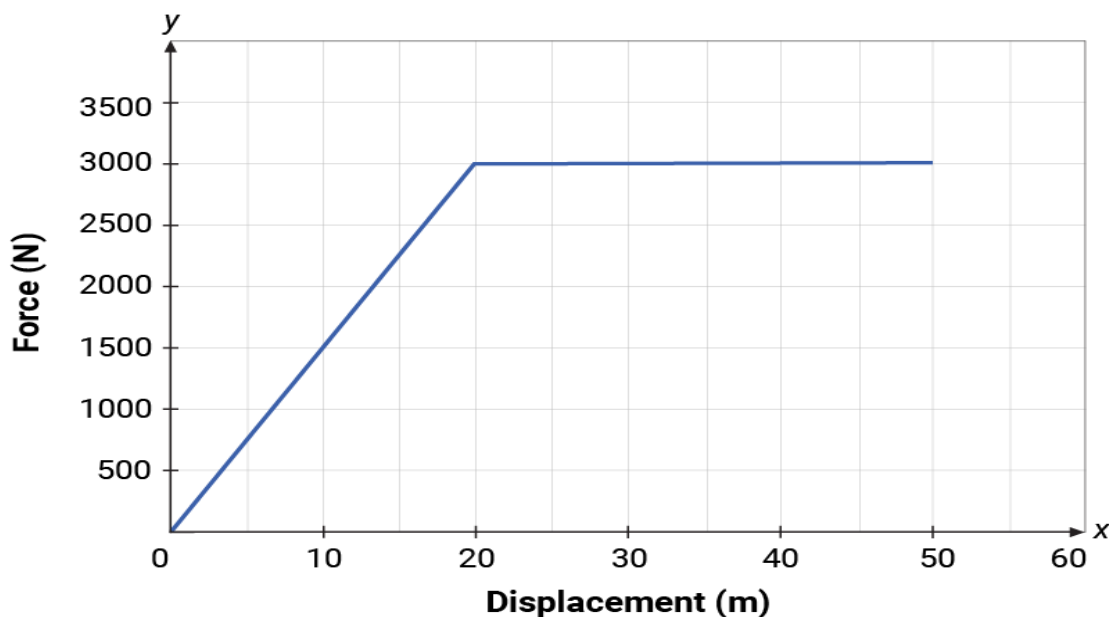


$$\begin{aligned}
 \text{WORK DONE} &= \text{Area of rectangle} \\
 &= (\text{length} \times \text{breadth}) \\
 &= 20.0 \times 1.50 = 30.0 \text{ J}
 \end{aligned}$$

$$\begin{aligned}
 \text{WORK DONE} &= \text{Area of triangle} \\
 &= \left(\frac{1}{2} \text{ base} \times \text{height} \right) \\
 &= \frac{20.0 \times 1.50}{2} = 15.0 \text{ J}
 \end{aligned}$$

Al Shawamekh Cycle 2 & 3 School for Girls

5. Calculate the work done by the force.



Energy:

- It is the ability to do work
- SI Unit of energy is **joules (J)**

A. Gravitational potential energy (PE_g)

It is the energy that an object has as a result of its position in a gravitational field. It is calculated in joules as follows,

$$PE_g = mgh$$

m = mass (kg)

Al Shawamekh Cycle 2 & 3 School for Girls

g = gravitational field (N/kg)

h = height (m) above a reference point, like the floor.

B. Kinetic Energy(KE)

Kinetic energy is the energy associated with motion.

Energy due to changing position is called translational kinetic energy

$$KE_{\text{trans}} = \frac{1}{2}mv^2$$

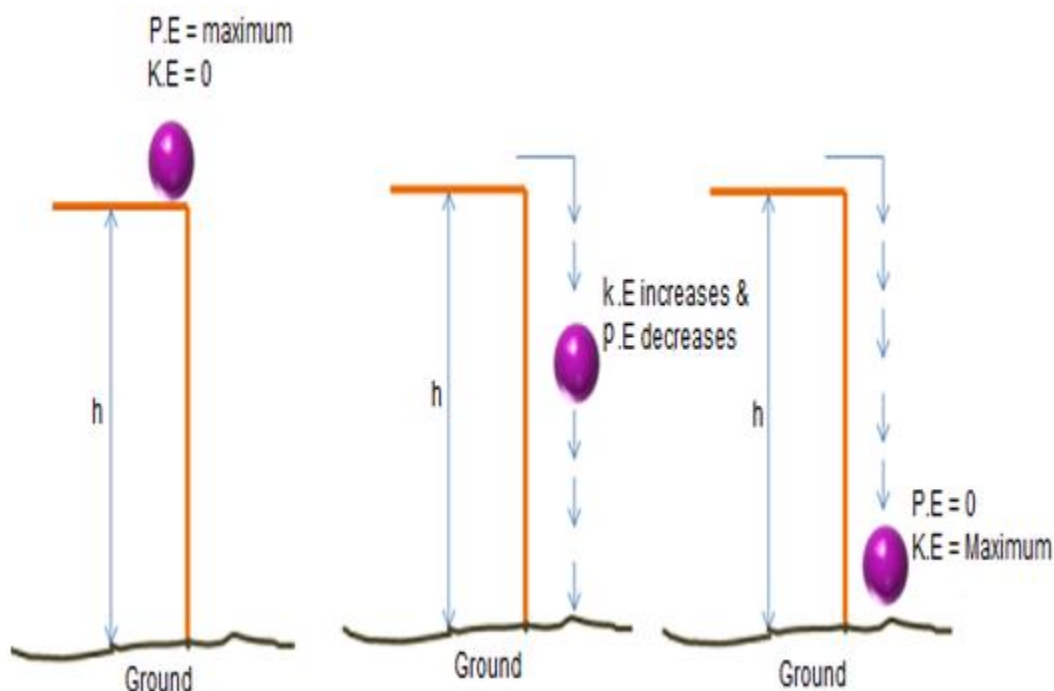
KE = kinetic energy (J)

m = mass (kg)

v = speed (m/s)

The **work-energy theorem** states that the work done (W) on a system is equal to the change in energy (ΔE) of the system,

$$W = \Delta E$$



Work done to lift a box from the floor to the top of a wardrobe, so the work-done is converted to potential energy

Al Shawamekh Cycle 2 & 3 School for Girls



As the box falls off- its potential energy reduces, but its kinetic energy increases



Its kinetic energy will be maximum just before it hits the floor, which will be same as its potential energy at the highest point

Power is equal to the change in energy divided by the time required for the change.



$$P = \frac{\Delta E}{t} = \frac{W}{t} = \frac{F \times d}{t} = F \times v$$



Power has the unit - **Watt (W)**. $W = J/s$



One Watt is equal to 1 J of energy transformed in 1 s.



1ton= 1000 kg



1 L of water has mass = 1kg

Practice questions:

6. A 100 N force is applied at an angle of 30° to the horizontal to move a 15 kg block at a constant velocity. Determine the amount of work done in moving the block a horizontal distance of 5 m.

a. 250 J

b. 433 J

c. 500 J

d. 636 J

Al Shawamekh Cycle 2 & 3 School for Girls

7. Power is defined as the change in energy divided by the time required for the change, $P = \frac{\Delta E}{t}$ Which of the following formulae cannot be used to solve for power?

a. $P = (F)(v)$

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

c. $P = \frac{Fd}{t}$

d. $P = \frac{Fv}{t}$

8. A ball of mass 0.5 kg falls from a height of 45 m. Using energy considerations, find the final velocity. Let $g = 9.8 \text{ m/s}^2$

a. 2.97 m/s

b. 21.0 m/s

c. 29.7 m/s

d. 44.1 m/s

9. A truck applies a force of 2000 N to pull a car out of a hole. The car is pulled 8 meters in 10 seconds. What power does the truck produce in order to move the car?

a. 1600 W

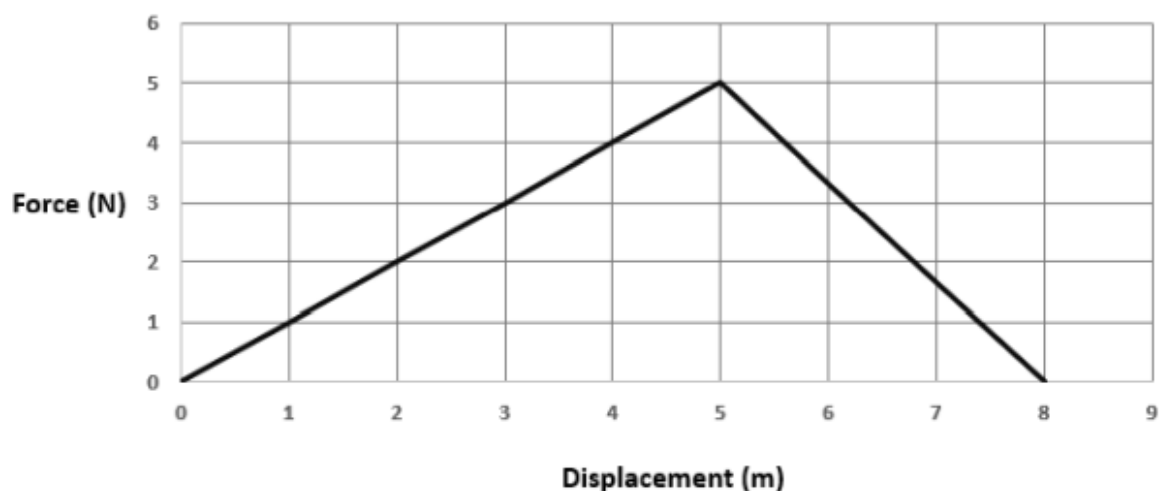
b. 1600 J

c. 16000 W

d. 16000 J

Al Shawamekh Cycle 2 & 3 School for Girls

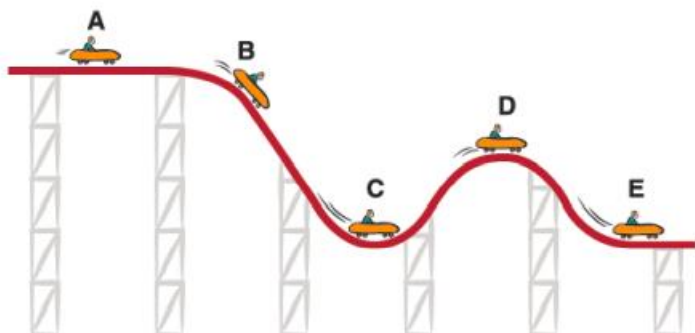
10. A force is applied to an object and causes the object to move as shown in the above graph.



How much work is done when the object moves from 0 m to 8 m?

- a. 13 J
- b. 16 J
- c. 20 J
- d. 40 J

11. The conservation of mechanical energy must be considered when designing roller coasters. Looking at the above diagram, which of the following statements is false?



Al Shawamekh Cycle 2 & 3 School for Girls

- a. The gravitational potential energy is greatest at point A.
- b. The kinetic energy is greatest at points C and E.
- c. The gravitational potential energy is lowest at points C and E.
- d. The kinetic energy is greater than gravitational potential energy at point B.

12. Fathima throws a ball with a force of 63 N, a distance of 25 m. Maitha throws the ball with the same amount of force, but the ball only goes 17 m. Which girl does less work?

- a. They do the same amount of work.
- b. Fathima
- c. Maitha
- d. Neither girl does any work.

13. An engine pushes a frictionless truck with a force of 800 N for 40 m. The truck has a mass of 2000 Kg. How much work does the engine do on the truck?

- a. 32 kJ
- b. 32 kW
- c. 80 kJ
- d. 80 kW

Al Shawamekh Cycle 2 & 3 School for Girls

ESE EXAM QUESTIONS

A car engine uses a force of (**29 kN**) to power a car at an average speed of (**7.5 m/s**). What is the average **power** of the engine?

يؤثر محرك سيارة بقوة مقدارها (**29kN**) لتشغيل السيارة بمتوسط سرعة مقدارها (**7.5 m/s**) ، ما هو متوسط **القدرة** لهذا المحرك؟

a.

217.50 kW

b.

3.87 kW

c.

2.17 kW

d.

0.26 kW

Which of the following equals **energy divided by the time required to this change** ?

أي من الآتي يساوي **التغير في الطاقة مقسوماً على الزمن اللازم لحدوث التغير**؟

Efficiency
الكفاءة

Power
القدرة

Work
الشغل

Kinetic energy
الطاقة الحركية

Al Shawamekh Cycle 2 & 3 School for Girls

Salma pulls a suitcase with a force of (**50 N**), that is applied along the handle at an angle of (**60°**) to the horizontal. How much work has Salma done after walking a distance of (**15m**), horizontally?

تسحب سلمى حقيبة أمتعة وتؤثر بقوة (**50N**) على طول مقبض الحقيبة الذي يميل بزاوية (**60°**) على الأفقي، ما مقدار الشغل الذي تبذله سلمى حين تقطع مسافة أفقية قدرها (**15m**)؟

375J

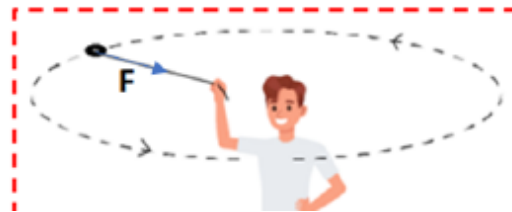
750 J

650 J

900J

Salem ties a ball to the end of a (**1.0 m**) string and swings the ball in a circle. If the string exerts a (**10 N**) force on the ball, how much **work** does the string do on the ball during a swing of one complete circle?

يربط سالم كرة بطرف خيط بطول (**1.0m**) ويحرك الكرة في مسار دائري. إذا كان الخيط يؤثر بقوة (**10N**) على الكرة، فما مقدار الشغل الذي يبذله الخيط على الكرة خلال دورة واحدة كاملة؟



62.3J

0.0J

31.1J

10.0J

Al Shawamekh Cycle 2 & 3 School for Girls

A weightlifter lifts (**300 kg**), from the ground to a height of (**2.0 m**) in (**3.0s**). What is the average power generated by him?

رافع اثقال يرفع (**300 kg**) من سطح الأرض إلى ارتفاع (**2.0m**) خلال (**3.0s**) . ما مقدار متوسط القدرة التي يبذلها؟



1800 W

1960 W

200 W

450 W

Which of the following examples shows **kinetic energy**?

أي من الأمثلة التالية يعبر عن **الطاقة الحركية**؟

a.

A river flowing down a hill

نهر يتدفق إلى أسفل التل



Al Shawamekh Cycle 2 & 3 School for Girls

b.

The battery of light flash

بطارية ضوء الفلاش



c.

A golf ball placed at the edge of the hole

كرة جولف موضوعة عند حافة الحفرة



d. **Energy stored in a bow and arrow**

الطاقة المختزنة في القوس والسهم



Al Shawamekh Cycle 2 & 3 School for Girls

In a curling game, a player does work to slide a stone of mass **(2.5kg)** from **rest** on the ice surface, as shown in the figure. He exerts a horizontal force of **(40N)** on the stone over a distance of **(1.5m)** then releases the stone.

What is the **velocity** of the stone at the point of release on ice surface?

(Consider the ice surface to be frictionless)

في لعبة الكيرلنج، يبذل لاعب شغلاً لتحريك حجر كتلته **(2.5kg)** من السكون على سطح الجليد كما هو موضح بالشكل. يؤثر اللاعب على الحجر بقوة **(40N)** أفقياً لمسافة **(1.5m)** ثم يطلق الحجر. كم تبلغ **سرعة** الحجر لحظة إطلاقه على سطح الجليد؟
(اعتبر أن سطح الجليد عديم الاحتكاك تماماً.)

2.37m/s

6.93m/s

13.8m/s

3.45m/s