

STEM SMART Phase One, 2022

Physics Week 7 – Energy

https://isaacphysics.org/gameboards#smart_p_1_7



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Essential GCSE Physics 33.2

GCSE - Practice (P1) A Level - Practice (P1)

A builder needs to drag a sack of cement 20 m along the floor against a friction force of 60 N.

Part A Work Done

Calculate the work done.

Part B Power

If the builder took two minutes to do the dragging, what was their power?



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Essential GCSE Physics 33.5

GCSE - Practice (P1) A Level - Practice (P1)

| A lighting bar on stage has a mass of $300\mathrm{kg}$ when supporting stage lights. |
|---|
| Part A Weight |
| What is its weight? |
| Part B Energy to lift How much energy do you need to lift it by $10\mathrm{m}$? |
| Part C Time to lift $\label{eq:continuous} \mbox{If your power is $100W$, how long would it take you to lift the bar by $10m$?}$ |
| Part D Gravitational potential energy What is the increase in gravitational potential energy when the bar is lifted by $10\mathrm{m}$? |



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Essential GCSE Physics 34.2

GCSE - Practice (P1)

| Calculate the kinetic energy of an $800\mathrm{kg}$ car when it is going at | |
|---|--|
| Part A Kinetic energy at 30 mph | |
| $30\mathrm{mph}$ (which is $13.4\mathrm{m/s}$); | |
| Part B Kinetic energy at 40 mph $40\mathrm{mph} \ (\mathrm{which} \ \mathrm{is} \ 17.9\mathrm{m/s}).$ | |
| Part C Road safety Road safety campaigners are continually reminding motorists that 40 mph is much more dangerous than 30 mph even though it only seems a little bit faster. What does this question suggest about the issue? The kinetic energy is a lot greater, almost double. 40 mph is actually safer than 30 mph. The difference between the two is actually minimal. | |
| | |



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Essential GCSE Physics 34.3

GCSE - Practice (P1)



Calculate the kinetic energy of a 20 tonne bus travelling at 40 mph [1 tonne = 1000 kg].

Part B F1 kinetic energy

Calculate the kinetic energy of a $600\,\mathrm{kg}$ Formula 1 race car going at $83\,\mathrm{m/s}$ [about $190\,\mathrm{mph}$], and compare it to that of the bus.



Essential Pre-Uni Physics B8.2

GCSE - Challenge (C3) A Level - Practice (P1)

Physical constants which may be necessary to answer the problems on this page can be found within the hint tabs.

Part A GPE lost by the ball

An object of mass $3.5\,\mathrm{kg}$ slides all the way down a slope inclined at 40° to the horizontal, with a base of length $4.8\,\mathrm{m}$. How much GPE does the object lose?

Part B Work done by the ball against friction

If the average frictional forces are 4.0 N, work out how much work the object does against friction.



Essential Pre-Uni Physics B8.3

GCSE - Challenge (C1) A Level - Practice (P1)

Physical constants which may be necessary to answer the problems on this page can be found within the hint tabs.

 $50\,\mathrm{J}$ of work is done in stretching a spring to an extension of $3.5\,\mathrm{cm}$. Work out the average force applied.



Essential Pre-Uni Physics B8.4

GCSE - Challenge (C1) A Level - Practice (P1)

Physical constants which may be necessary to answer the problems on this page can be found within the hint tabs.

A boy whirls a $30\,\mathrm{g}$ conker around his head in a circle at a speed of $2.2\,\mathrm{m\,s^{-1}}$, using a taut inextensible string. How much work is done on the conker by the tension in the string?



Essential Pre-Uni Physics B8.7

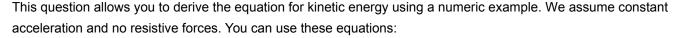
GCSE - Challenge (C1) A Level - Challenge (C1)

A child of $40\,\mathrm{kg}$ rides a $35\,\mathrm{kg}$ bike at $9.0\,\mathrm{m\,s^{-1}}$. The brakes are then applied and the bike is slowed to $3.8\,\mathrm{m\,s^{-1}}$. How much work is done by frictional forces?

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Essential GCSE Physics 34.9

GCSE - Challenge (C1)



 $\begin{aligned} & \text{distance} = \text{average speed} \times \text{time} \\ & \text{acceleration} = \text{change in speed} \ / \ \text{time taken} \\ & \text{force} = \text{mass} \times \text{acceleration} \\ & \text{energy transferred} = \text{force} \times \text{distance} \end{aligned}$

Part A Acceleration

A $700\,\mathrm{kg}$ car accelerates uniformly from rest to $30\,\mathrm{m/s}$ in $10\,\mathrm{s}$. Calculate its acceleration.

Part B Force

Calculate the force needed to give the car this acceleration.

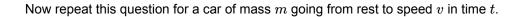
Part C Distance

The average speed of the car is midway between the starting speed $(0.0\,\mathrm{m/s})$ and the final speed. Use this information to work out how far the car will go while accelerating.

Part D Kinetic energy

The kinetic energy equals the work done in accelerating the car. Use this fact to calculate the kinetic energy.

Part E Symbolic



The following symbols may be useful: E, $\,$ m, $\,$ t, $\,$ v



Essential Pre-Uni Physics B8.9

GCSE - Challenge (C3) A Level - Challenge (C1)

Physical constants which may be necessary to answer this problem can be found within the hint tab.

A $4.0\,\mathrm{kg}$ ball is thrown vertically up into the air with an initial velocity of $8.5\,\mathrm{m\,s^{-1}}$. By the time it is height h metres above the starting point, it has a velocity of $3.0\,\mathrm{m\,s^{-1}}$ and has done $4.0\,\mathrm{J}$ of work against air resistance. Find h.