Essential Pre-Uni Physics B3.9

GCSE A Level

Assume that any dropped or thrown object accelerates downwards at $9.8\,\mathrm{m\,s^{-2}}$. If a question says that an object is 'dropped' this means that its velocity is zero at the beginning of the motion.

Please give your answers to 2 significant figures. If asked for a velocity or displacement, your answer MUST contain a direction in order to be marked as correct. Take the positive direction to be upwards.

You want to fire a ball vertically into the air so that it goes $100\,\mathrm{m}$ up before coming back down again (its maximum height is $100\,\mathrm{m}$). How fast should you fire it?

Essential Pre-Uni Physics B8.2

GCSE C C C A Level P P P

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 $4.0\,\mathrm{N}$, work out how much work the object does against friction.

Essential Pre-Uni Physics B8.6

GCSE C C C A Level P P P

A $1300\,\mathrm{kg}$ car travels at a steady speed, covering $75\,\mathrm{m}$ in 5.0 seconds. Frictional forces are constant and are $450\,\mathrm{N}$ in total. Work out the power output of the engine, assuming $100\,\%$ efficiency.

Essential Pre-Uni Physics B4.7

A Level

You are trying to drop essential survival supplies from an aeroplane to help the survivors of a crash who are stranded. You are flying $300\,\mathrm{m}$ above them, and your aircraft can travel no slower than $30\,\mathrm{m\,s^{-1}}$. You fly on a straight line which will pass over the survivors.

How far (in metres) in advance of overflying the survivors do you need to drop the package? Assume that the downward acceleration is $9.8\,\mathrm{m\,s^{-2}}$. Please give your answer to 2 significant figures.

Essential Pre-Uni Physics B2.2

GCSE A Level

Where bearings are given, they are in degrees East of North (so North is 000°, East is 090°, South is 180° and West 270°). For the purposes of this exercise, assume the Earth is flat.

Part A Rowing speed

a) Work out how fast I am going (relative to a ground-based observer) if I row at $9.0\,\mathrm{m\,s^{-1}}$ South (relative to the water) in a river where the water is flowing $1.0\,\mathrm{m\,s^{-1}}$ South.

Part B Swimming speed

b) Work out how fast I am going (relative to a ground-based observer) if I swim at $1.0\,\mathrm{m\,s^{-1}}$ North (relative to the water) in a river where the water is flowing $0.30\,\mathrm{m\,s^{-1}}$ East.

Part C Swimming direction

c) In what direction would a ground-based observer think I was swimming in part (b)? Give your answer as a number of degrees East of North (a bearing). Give your answer to 2 significant figures.

Part D Flying speed

d) Work out how fast I am going (relative to a ground-based observer) if I fly at $100\,\mathrm{km\,h^{-1}}$ North-West (relative to the air) when the wind is blowing from the North-East at a speed of $20\,\mathrm{km\,h^{-1}}$. Give your answers to 2 significant figures.

Essential Pre-Uni Physics B5.3

A Level

The strength of Earth's gravity at ground level = $9.8\,\mathrm{N\,kg^{-1}}$. 1 tonne = $1000\,\mathrm{kg}$.

Where forces are asked for, ensure that the direction is in the answer (e.g. up/down). Assume that the mass is evenly distributed in the rulers, poles, planks, bridge spans mentioned in the questions.

A $200\,\mathrm{m}$ bridge span is supported at both ends. The span has a mass of $100\,\mathrm{tonnes}$. A $30\,\mathrm{tonne}$ bus is $50\,\mathrm{m}$ from one end of the span. Calculate the supporting force holding the bridge up at the end nearer the bus. Please give your answer to 2 significant figures.

Essential Pre-Uni Physics B5.7

A Level

Figure 1: Diagram showing the pub sign.

The pub sign shown above is supported by a hinge and by a metal rod.

Note: The strength of Earth's gravity at ground level = $9.8\,\mathrm{N\,kg^{-1}}$.

Calculate the tension in the rod if the pub sign is an $80\,\mathrm{cm}$ square of mass $30\,\mathrm{kg}$. Ignore the mass of the rod, assume that the hinge is well-oiled, and assume that the mass is evenly distributed in the sign. Give your answer to 2 significant figures.

Essential Pre-Uni Physics B4.8

A Level

A rugby player is aiming for a conversion. He kicks the ball at $15\,\mathrm{m\,s^{-1}}$ at an angle of 50° to the horizontal. At the time, he is $20\,\mathrm{m}$ from the posts.

Assume that the downward acceleration is $9.8\,\mathrm{m\,s^{-2}}$.

Part A Time to reach the posts

How much time will the ball take to reach the posts?

Part B Height at the posts

How high will the ball be when it reaches the posts?

Essential Pre-Uni Physics B1.6

GCSE C C C A Level C C C

A trolley has a weight of $11\,\mathrm{N}$ and sits on a ramp inclined at 33° to the horizontal. How big is the component of the weight which is trying to pull the trolley along the ramp? Give your answer to 2 significant figures.

Essential Pre-Uni Physics B3.4

GCSE A Level

A high performance car can travel from rest to $25\,\mathrm{m\,s^{-1}}$ in $5.0\,\mathrm{s}$.

Part A Acceleration

What is its acceleration?

Part B Distance travelled

How far does the car travel while accelerating?