Name: ____________________________ Class: ______

Additional Science Homework

P2 Physics for your future

Topic 4: Momentum, energy, work and power

4.13 Use the fundamental equation for power

A cyclist transfers 7.2 x 10^4 J in 10s. What is her power?

E=_______
t=________
P= ??

Equation: _______________
Insert values: _______________
Answer: P=_______ unit:_______

A jet fighter has a power of 1.5 x10^6 W. How much work does it do in two minutes?

E= ??
t=_________
P=_________

Equation: _______________
Rearranging:
Insert values: _______________
Answer: E=_______ unit:_______

A boy racer drives his Vauxhall Corsa a distance of 1.3x10^5m against a drag force of 6400N. It has a power of 154 kW. How long has his journey taken?

E= ??
t= ??
P=_________
F=_________
d=_________

Working out E
Equation: _______________
Insert values:_______________
Answer: E=_______ unit:_______

Working out t
Equation: _______________
Rearranging:
Insert values:_______________
Answer: t=_______ unit:______

4.15 Use the equation for gravitational potential energy (GPE)

Equation for GPE: _______________Unit:______

A fell-runner runs up a 200m high hill. He has a mass of 75kg. How much gravitational potential energy does he have at the top of the hill?

m=_________
h=_________
g=_________
GPE= ??

Equation: _______________
Insert values: _______________
Answer: GPE=______ unit:______

An aircraft of mass 4.0 x 10^5 kg is cruising at a high altitude. It has 2.0 x 10^{10} J of GPE. What is its altitude?

m=_________
h= ??
g=_________
GPE=______

Equation: _______________
Rearranging:
Insert values: _______________
Answer: h=_______ unit:_______

An Ipad is on a desk 1.2m from the ground. It has 8.16J of GPE. What is its mass?

m= ??
h= _________
g=_________
GPE=______

Equation: _______________
Rearranging:
Insert values: _______________
Answer: m=_______ unit:_____

4.16 Use the equation for kinetic energy

Equation: _________________ Unit:___________

A motorbike of mass 300kg is travelling at 15m/s. How much kinetic energy does it have?

m=_________
v=_________
KE= ??

Equation: _______________
Insert values: _______________
Answer: KE=_______ unit:_______

Another motorbike has the same amount of kinetic energy, but a mass of 200kg. How fast is it moving?

m=________
V= ??
KE=________

Equation: _______________
Rearranging:
Insert values:_______________
Answer: v=_______ unit:_____

4.17 Demonstrate an understanding of the idea of conservation of energy in various energy transfers

A diver has 4000 J of ________ _______ energy at the start of the jump. He has _____J of ________ energy as he enters the water.

Calculate the velocity of the Ipad in section 4.15 when it hits the ground.

GPE=_______
KE= _______
m=________
v= ??

Equation: _______________
Rearranging:
Insert values:_______________
Answer: v=_______ unit:_______

4.18 Carry out calculations on work done to show the dependence of braking distance for a vehicle on initial velocity squared (work done to bring a vehicle to rest equals its initial kinetic energy)

A car of mass 1000kg does an emergency stop from 15m/s to rest, applying a force of friction 8 000 N

The same car does another emergency stop, this time from 30m/s, applying the same force.

For each car, calculate the distance travelled to come to rest.

m=_______
v= _______
E= ??
F=_________
d= ??

Equation: _______________
Insert values:_______________
Answer: E=_______ unit:_______
Equation: _______________
Rearranging:
Insert values:_______________
Answer: d=_______ unit:_______

m=_______
v= _______
E= ??
F=_________
d= ??

Equation: _______________
Insert values:_______________
Answer: E=_______ unit:_______
Equation: _______________
Rearranging:
Insert values:_______________
Answer: d=_______ unit:_______

Conclusion

When the velocity is doubled, the stopping distance ___________ because___________
____
____
____
____
____
____

4.1 Recall how the stopping distance of a vehicle is related to the thinking distance and the braking distance

_________ distance = __________ distance + __________ distance

4.2 Demonstrate an understanding of the factors affecting the stopping distance of a vehicle, including:

a the mass of the vehicle, b the speed of the vehicle, c the driver's reaction time, d the state of the vehicle's brakes, e the state of the road, f the amount of friction between the tyre and the road surface

Factor	Affects thinking distance	Affects braking distance	Reason
Mass of the vehicle			
Speed of the vehicle			
Distractions (loud music, mobile phone)			
Drugs / alcohol			
Faulty brakes			
Ice / rain on road			
Road surface worn down			

4.3 Investigate the forces required to slide blocks along different surfaces, with differing amounts of friction

Describe how you would set up an experiment to measure the force required to slide a block over surfaces to compare the friction provided by different surfaces:____

____

____

____

4.4 Use the equation linking momentum, mass and velocity to calculate the momentum of a moving object

A car of mass 1200kg travels at 5m/s. Calculate its momentum, showing your workings:

m=_______
v=_________
p= ??

Equation: ______________

Insert values: ______________

Answer: p=_______ unit:_______

4.5 Demonstrate an understanding of momentum as a vector quantity

A 'vector quantity' is a quantity which has _______ and _______. Which of the following is ***not*** a vector quantity?

a. Momentum
b. Mass
c. Velocity

Explain your answer: ______________________________

____

____

4.6 Demonstrate an understanding of the idea of linear momentum conservation

Linear momentum means momentum in a straight _______.

Conservation of linear momentum means that the ______ linear momentum is _________ ________ before and after a _________.

A train carriage of mass 12 000 kg, moving at 1.5m/s collides and joins with a stationary train carriage of mass 15 000 kg. Calculate the velocity of the two joined carriages after the collision.

Before the collision

m=_______
v=_________
p= ??

Equation: ______________

Insert values: ______________

Answer: p=_______ unit:_______

After the collision

m=_______
v= ??
p= _________

Equation: ______________

Rearranged: ______________

Insert values: ______________

Answer: v=_______ unit:_______

4.7 Demonstrate an understanding of the idea of rate of change of momentum to explain protective features including bubble wraps, seat belts, crumple zones and air bags

When a car cashes, its momentum is reduced to _______. This can happen in a long or short time. If the reduction of momentum takes a long time, we say this is a **(high/low)** rate of change of momentum. If the reduction of momentum takes a short time, we say this is a **(high/low)** rate of change of momentum. Explain how bubble wrap, seat belts, crumple zones and air bags reduce the rate of change of momentum:____

____

____

____

4.8 Investigate how crumple zones can be used to reduce the forces in collisions

Describe how you would use an accelerometer (acceleration recording device), a dynamics trolley, art straws and bubble wrap to investigate the hypothesis that the thickness of a crumple zone affects the force suffered by the trolley:

____

____

____

____

____

4.9 Use the equation which links force with change in momentum and time to calculate the change in momentum of a system, as in 4.6

The car in 4.4 crashes into a brick wall, taking 0.1s to lose all of its momentum (come to a stop). Calculate the average force suffered by the car.

m=_______
v=________
u=________
t=________
F= ??

Equation: ______________

Insert values: ______________

Answer: F=_______ unit:_______

A 0.2kg snooker ball collides with another ball, taking 0.0005s. Its velocity afterwards is 1m/s, still travelling in the same direction. The force involved is 100N.

m=_______
v=________
u=??
t=________
F=________

Equation: ______________

Rearranging:

Insert values: ______________

Answer: u=_______ unit:_______

4.10 Use the equation linking work done with force and distance

A girl drags her school bag 30m along the floor with a force of 150N. How much work has she done?

d=_______
F=_______
E= ??

Equation: ______________

Insert values: ______________

Answer: E=_______ unit:_______

She then puts her P.E. kit into her bag and continues to drag it another 15m, transferring 6000J before being told to put it on her shoulders. How much force did she have to apply?

d=_______
F= ??
E=_______

Equation: ______________

Rearranging:

Insert values: ______________

Answer: F=_______ unit:_______

If she had dragged it half this distance, how much work would she have done? Explain your answer:

____

____

4.11 Demonstrate an understanding that energy transferred (joule, J) is equal to work done (joule, J)

A woman has 50 000 J of GPE at the top of a diving board. How much work has she done by the time she hits the water? Explain your answer:____

____

4.12 Recall what power is and its unit & 4.14 Recall the unit for power in fundamental terms.

The unit for power is:________ This can also be written in as: _______

Power is defined as the rate of ______ _______ (energy transferred).

The equation for power is: _______________