Protecting your head: **Helmet crash test**

Force and energy
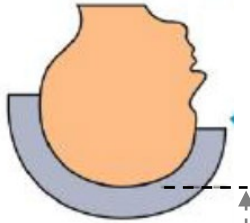
Protecting your head: Helmet crash test

Helmet (based on foam) is strapped on a 5kg headform
and dropped from 2m on anvil

➢ **Which force is encountered by the head if the impact crashes the foam by 3cm?**
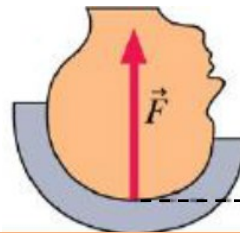➢ **Would the helmet protect the rider?**

Helmet crash test

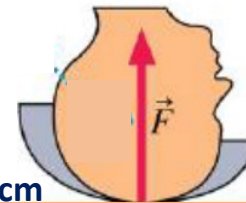|		
the headform is dropped from the height of 2m	- the helmet JUST touched the anvil - the foam is pushing on the headform	- the headform is subject to a large force from the foam - this force does negative work on the headform, slowing it down

$y=0$

$\vec{F}$

$\vec{F}$

d=3cm

BEFORE: $y_i = 2m, v_i = 0\ m/s$

AFTER: $y_f = 0m, v_f = 0\ m/s$

F=?

Helmet crash test

the headform is dropped from the height of 2m

y=0

BEFORE: $y_i = 2m, v_i = 0\ m/s$

- the helmet JUST touched the anvil
- the foam is pushing on the headform

$\vec{F}$

d=3cm

- the headform is subject to a large force from the foam
- this force does negative work on the headform, slowing it down

$\vec{F}$

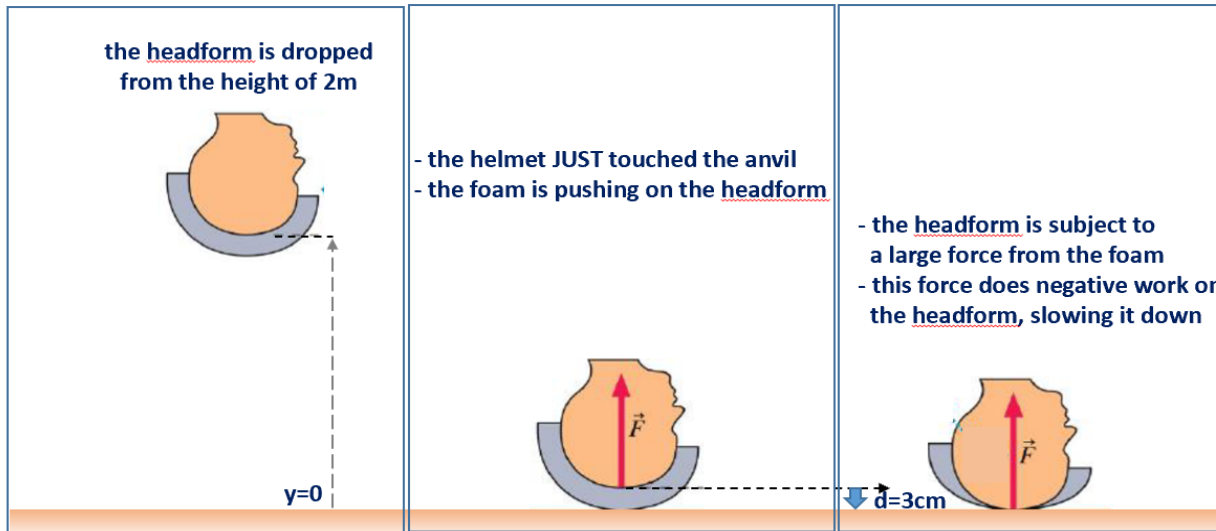**AFTER:** $y_f = 0m, v_f = 0\ m/s$

$$K_f = K_i = 0$$

$$U_f - U_i = W$$

$$W = -Fd$$

$$F = \frac{U_i - \overset{=0}{\cancel{U_f}}}{d} = \frac{5kg \cdot 9.8\frac{m}{s^2} \cdot 2m}{0.03m} = 3300N$$

And looking at acceleration gives:

$$a = \frac{F}{m} = \frac{3300N}{5kg} = 660\ \frac{m}{s^2}$$

$$\approx 66g$$

The accepted threshold for serious brain injury is around 300g

➢**The helmet would protect the rider**