Engineering Disciplines

You must know about different **Engineering disciplines** and the types of products produced by each of the disciplines.

Mechanical
Machinery, Hydraulics, gears and pulleys, mechanisms

Electrical and electronic
power station, household appliances, integrated circuits

Aerospace
aircraft, space vehicles, missiles

Communications
telephone, radio and fibre optic

Chemical
pharmaceuticals, fossil fuels, food and drinks

Civil
bridges, roads and railways

Automotive
cars, motorcycles and trains

Biomedical
prosthetics, medical devices and radiotherapy

Software
applications, systems and computer programming.

You must know how every product from each discipline on the list has solved problems and shaped the modern world.

Example: Bridges (Civil Engineering):

Problems solved: Bridges have allowed people and transport to cross over obstacles such as large bodies of water, roads and railways quickly and safely. Prior to a bridge being built people would either have to travel a long way around the obstacle,or make a potentially dangerous crossing. Both methods would be time consuming (slow) and possibly more hazardous or expensive.

They have shaped the modern world by making it easier and quicker to transport people and goods on foot, by road and by rail to places that might have been difficult to get to.

They have enabled people to work in places that they may not have been able to get to before. They have reduced the cost of goods by making them cheaper to transport. They have reduced journey times.lincluding queuing and crossing, taking a ferry over a river might add 30 minutes travel time to a journey. The same crossing over a bridge may take less than a minute.

Furthermore, they have improved safety as people no longer have to make dangerous crossings (e.g. by boat at night or in bad weather or by crossing busy roads or railway lines).
Finally, travelling long distances around obstacles will use more fuel and release more CO2, which is harmful to the environment, so bridges can have environmental benefits.

Likely to be an 8-10 mark question. Break it down into two sections:

Problems solved - Think about what the product actually does. Then explain what we can do now that we couldn't do easily before, because of the existence of the product in question.

How has it shaped the modern world? - List all of the possible benefits of the product. You must explain how or why each one is a benefit. Give examples where you can. For every point made, ask yourself 'so what?' then write your answer down after the point.

The Health and Safety Legislation Governing Engineering

Health and Safety in Engineering is important to ensure that every person is safe from harm or injury caused by accidents and hazards

Health and Safety at Work Act

- responsibilities of employers to their employees.
- responsibilities of employees at work.

Manual Handling Operations Regulations

- Ensuring no-one lifts items that might injure them.
- Training and risk assessment of all manual handling tasks

Personal Protective Equipment at Work Regulations

Eyes and ears - goggles, safety glasses, visors and ear protectors
Head and face – hard hats, helmets, bump caps
Respiratory – disposable filtering face-piece, full face respirators, breathing mask
Hand and arm – gloves, gauntlets, mitts, armlets
Clothing – disposable overalls, high visibility vest, aprons and boiler suits
Footwear – safety boots with protective toe caps, gaiters, spats.

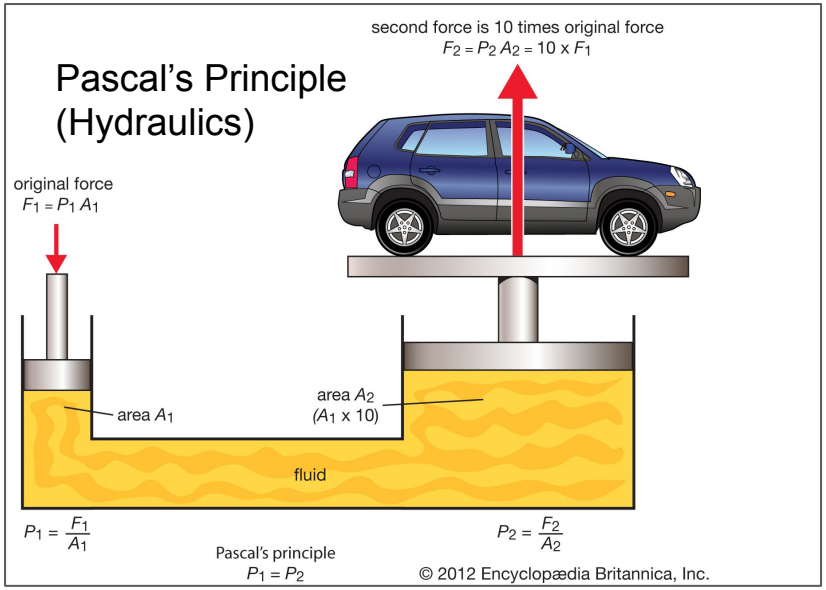
Control of Substances Hazardous to Health (COSHH)

- chemicals
- fumes
- dust.

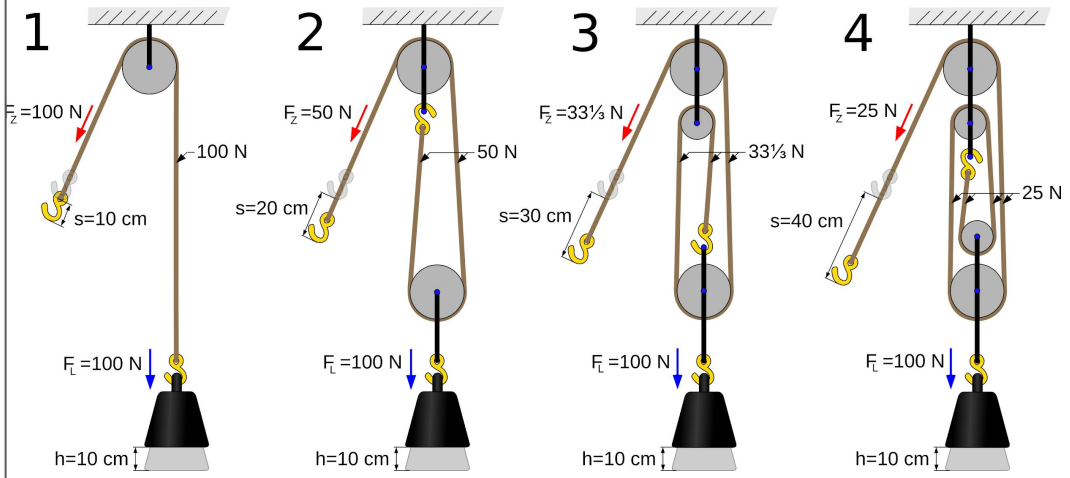
Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR)

- report forms (what information goes on them?)
- reportable incidents
- person responsible.

Pascal's Principle (Hydraulics)

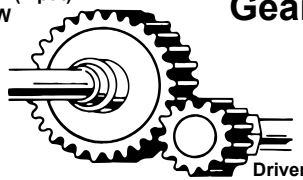


Pulley (block and tackle) Theory



Gears

Driver (input) SLOW



Driven (output) FAST

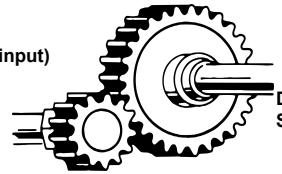
If the driver gear (input) is larger than the driven gear (output) then there will be an increase in speed.

The output gear will turn quicker than the input.
The trade off will be a reduction in turning force.

Useful in machines where high speed is needed but little resistance (food mixers).

In a car these gears are used for high speed driving where the car already has a lot of momentum as it is moving quickly.

Driver (input) Fast



Driven (output) SLOW

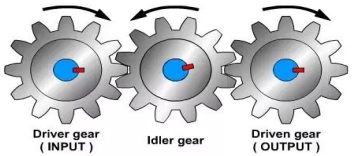
If the driver gear (input) is smaller than the driven gear (output) then there will be an reduction in speed.

The output gear will turn slower than the input.
The benefit will be an increase in turning force.

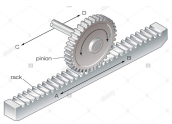
Useful in machines where heavy loads need moving using a low powered motor (automatic garage door)

In a car these gears are used pulling away from a stopped position or driving up a hill. This is because the force required is high.

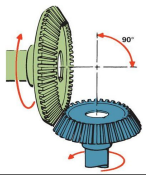
Gears can be used to change direction



When gears are placed next to each other they will change direction from clockwise to anti clockwise direction. An idler gear placed in the gear train will keep the direction of travel the same.



Rack and pinions can be used to change from rotary to linear movement.



Bevel gears can change the direction of travel through 90 degrees.

What do the COSHH symbols mean?

Dangerous to the environment

Toxic

Gas under pressure

Corrosive

Explosive

Flammable

Caution – used for less serious health hazards like skin irritation

Oxidising

Longer term health hazards such as carcinogenicity