

S&C GCSE June 2015 Model Answer

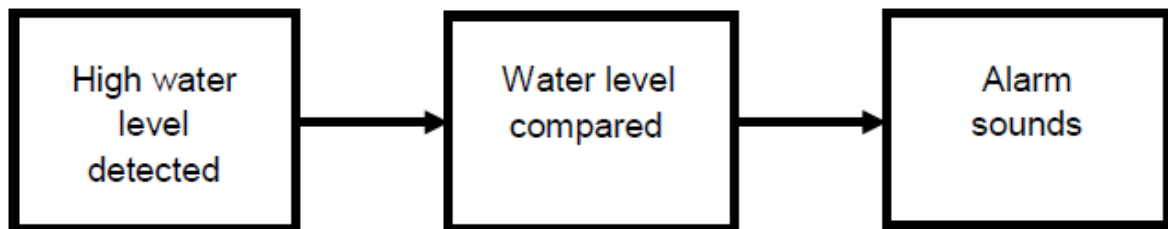
1a)

Process Box:

Should make reference to a comparison or a component suitable for making a comparison or should reference a threshold being reached or reference a component that will activate at a specific threshold.

Output Box:

Should make reference to an alarm or a component that will generate a visual or audible output.



1b)

Detection input sensor devices:

- Float switch



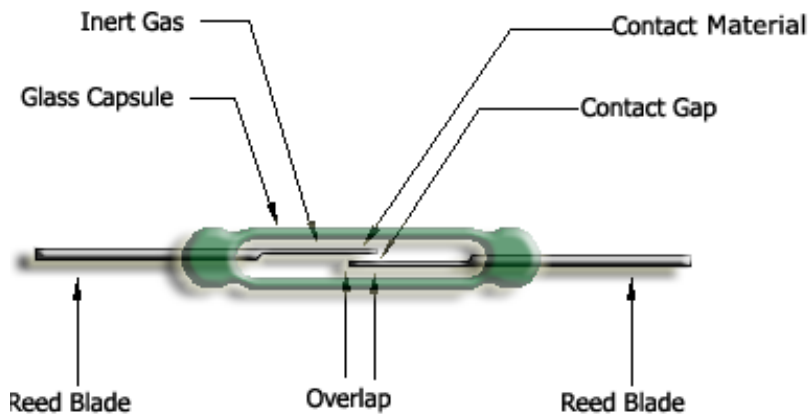
float switch on



float switch off

- Simple design that is fast acting and reliable.

- **Reed switch**



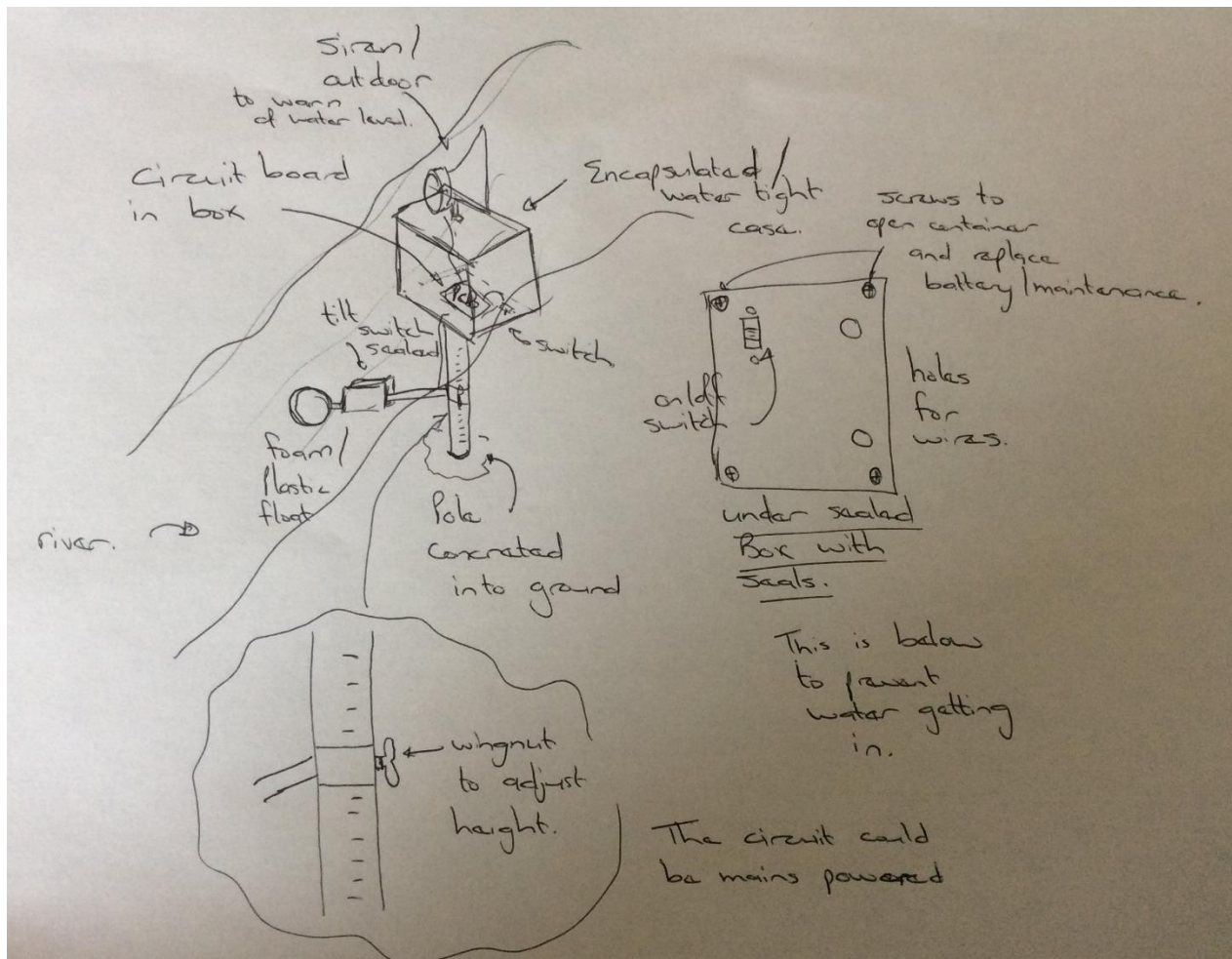
- Fully hermetically sealed metal contact. Reed switches can operate in moist and dust ambient conditions, active liquids and gases medium, at temperature variation from -60°C to +155°C. They have immunity to radiation.

- **Micro switch**



- The main advantage of micro switches is durability and consistency.
- Other responses are possible but may require some justification
 - Examples of justification are:
 - Lightweight
 - Waterproof
 - Reliable
 - Mechanical
 - Reference to output type (Digital or Analogue)
 - Low power
 - Adjustable

1c)



1d)

- The product will set off a loud outdoor siren when the water level is reached. This is placed on top of the water tight box.
- The level can be adjusted by loosening the wingnut and sliding the clamp up and down the pole. This has included a ruler to measure the height.
- All the parts are either waterproof or sealed in a water tight container. The switch and holes are placed below the box so as not allow water in.
- The power can be switched on and off from below. The box can be opened using the screws from below to replace a battery or for maintenance.
- The circuit could be mains powered if there is a power source nearby.
- The box could be coloured to blend into the environment.

1ei)

One off material: Should be water resistant E.g.

- Foamex
- Acrylic
- PVC
- Polystyrene
- Resin Cast
- Metals – Aluminium, Stainless, etc

One off Process: E.g.

- Vacuum form
- Blow mould
- Press form
- Line bend
- Laser cut
- Injection Moulding
- Fabrication
- Hand Tools
- 3D Printing

One off Reason related to material and process choice: E.g.

- Low cost
- Simple/ easy
- Quick/rapid
- Prototype so limited need for surface detail

For example - Acrylic sheet is readily available and easy to form on a line bender

1eii)

Batch of 5000 material: E.g.

- Polythene
- Polystyrene
- Nylon
- Polyurethane
- Polypropylene
- Acrylic
- PVC
- Metals – Aluminium, Stainless, etc

Batch of 5000 process: E.g.

- Injection mould
- Rotational cast
- Cast
- Press formed
- Vacuum form
- Blow mould
- Laser cut
- Fabrication

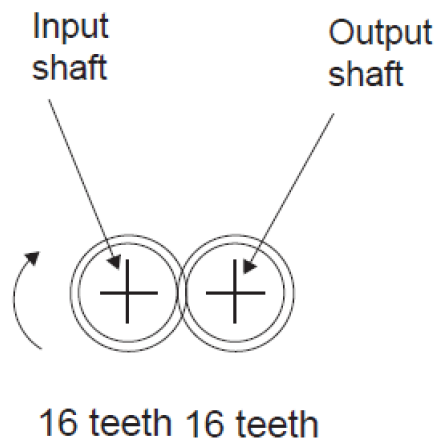
Batch of 5000 Reason for material and process choice: E.g. (1 mark)

- Low cost
- Accurate
- Complex shape

- Easy to reproduce
- Surface detail

Detailed reason - Reference to the above, well explained and drawn e.g. Polyurethane can be Injection moulded continually once the mould is produced – production size warrants production of moulds or jigs

2ai)



Shaft ratio = 1:1

The output direction = anti-clockwise or counter-clockwise.

Therefore the output speed = 1000rpm because the input speed = 1000rpm

2aii)

Output Shaft Direction Clockwise

Output Shaft Speed 500 rpm

2bi)

Heat is generated which causes a loss in energy, thus reducing the efficiency of the system. Damage will also occur due to the friction.

2bii)

A lubricant can be used to reduce friction and provide a thin layer of protection between the moving parts.

3a)

Input component LDR, Photodiode

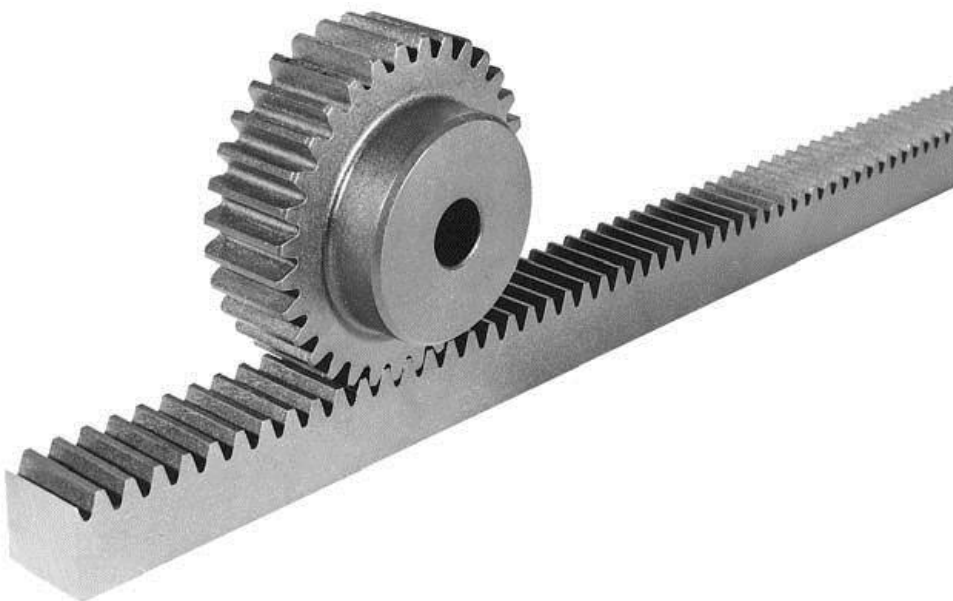
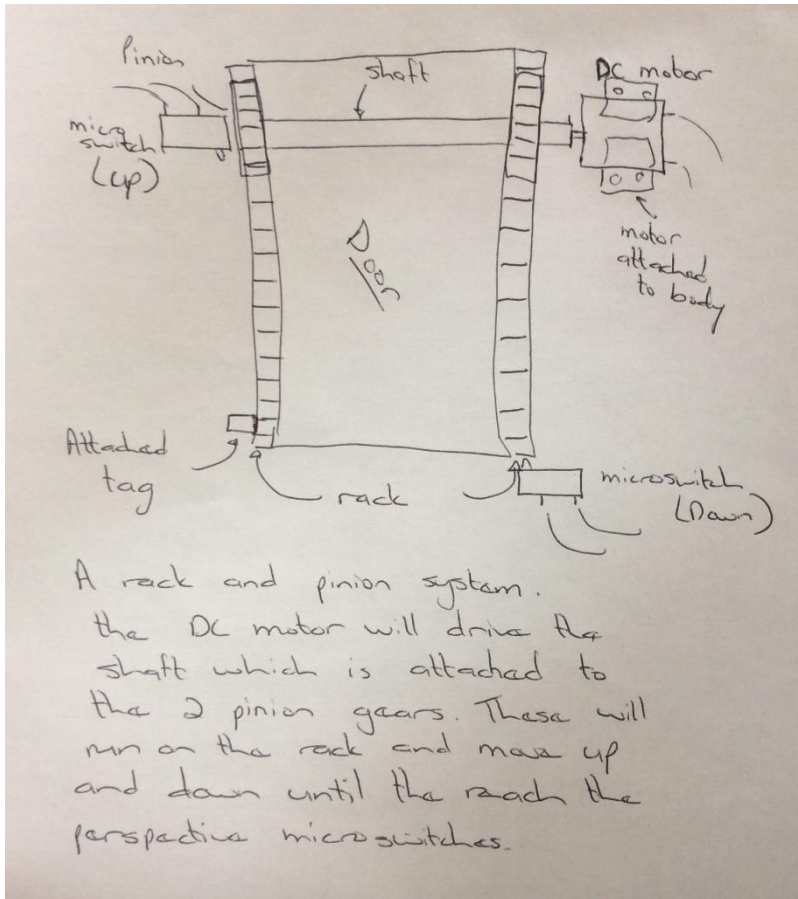
Process component PIC, Transistor, Micro Processor, Comparator, OP-Amp, Logic Gate

Output component Motor, Pneumatic Ram, Solenoid

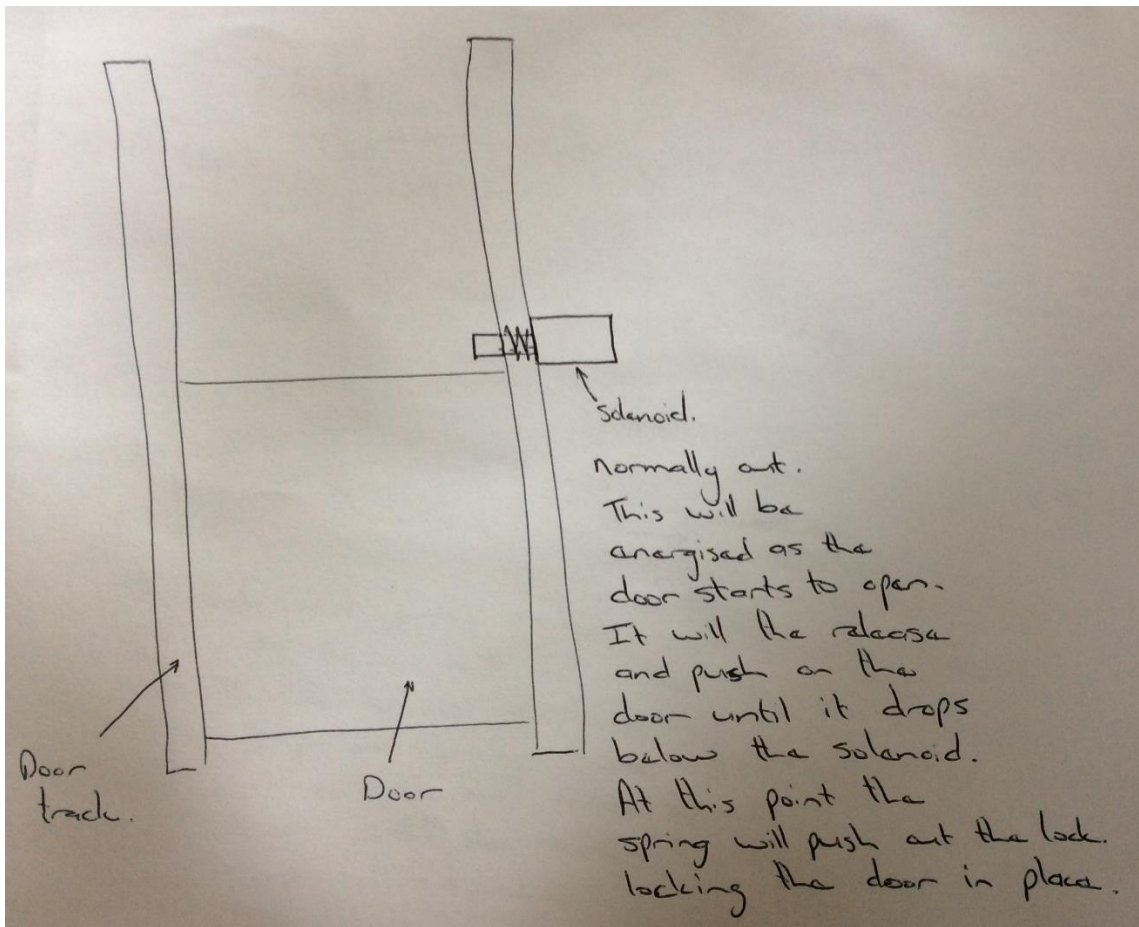
3b)

Linear

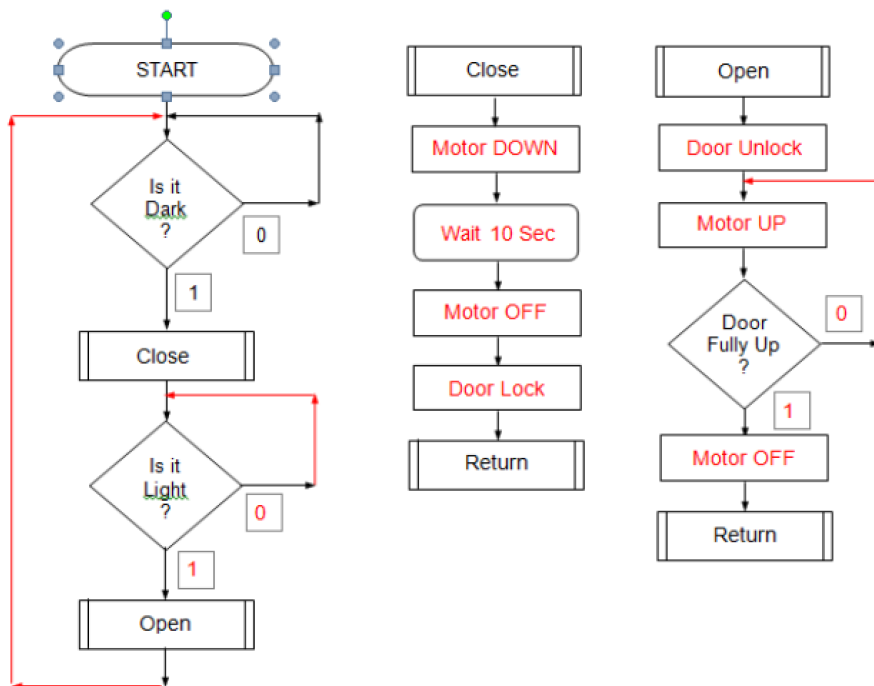
3c)



3d)



3e)



3f)

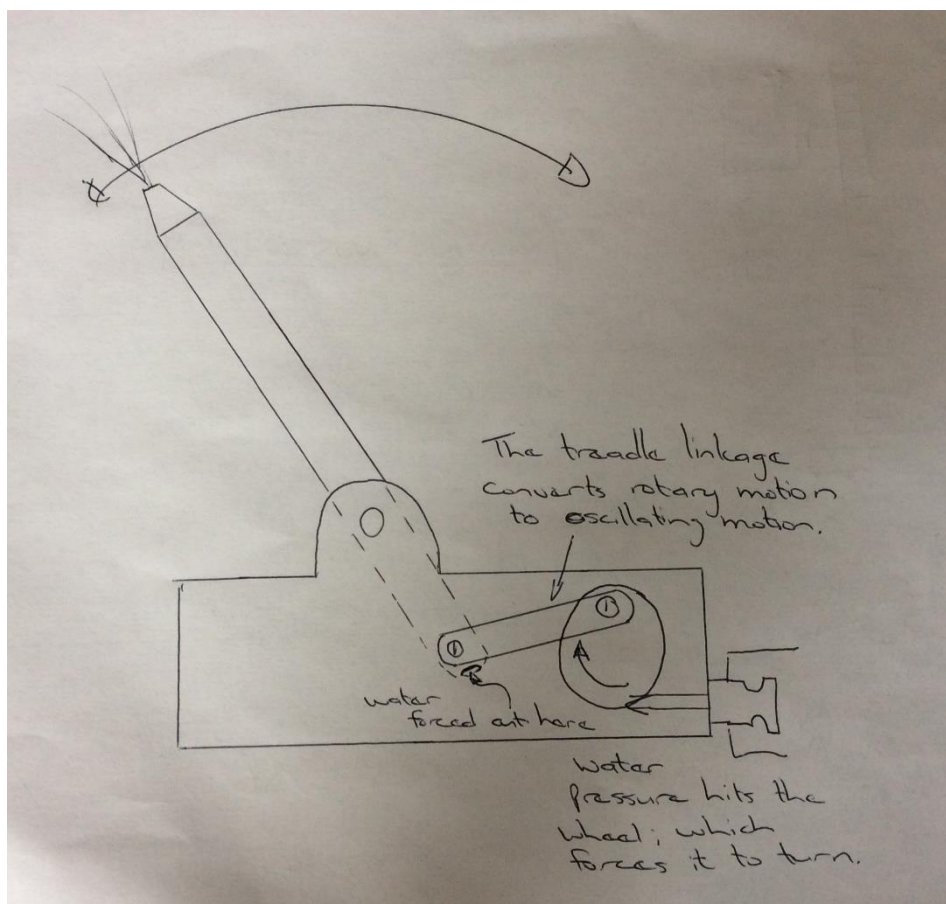
Suitable answer for the alternative energy source would be:

- Water Power
- Solar Panel
- Wind Turbine

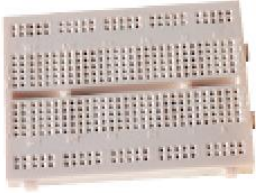
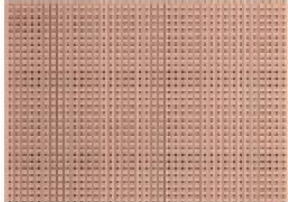
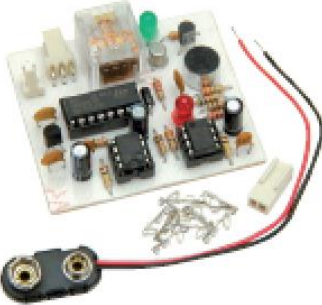
This will need to include an explanation of the system.

For example: A wind turbine will charge a battery to power the motor even when it is not windy.

4a)



5a)

	<u>Advantage:</u>	<u>Disadvantage:</u>
 <p>Prototyping Board (Breadboard)</p>	Easy to change components.	Fragile, has poor connections.
 <p>Copper Strip Board (Veroboard)</p>	More robust than a breadboard.	Larger than a PCB. Difficult to plan circuit/joined tracks.
 <p>Printed Circuit Board</p>	Compact, durable, repeatable, Easier to find fault.	Takes time to design and make.

5b)

Suitable advantages

- You don't need all the components / cost effective
- Easily edited / modified
- Can be tested / monitored
- Allows planning of component layout
- Links to PCB design
- No components are damaged if circuit fails.
- Quicker as you don't need to find the components

5c)

Suitable disadvantages

- The computer may not be as accurate
- More expensive as you need a PC
- Need for appropriate software
- Not all components available
- Higher level of skill needed to operate the PC
- Not true representation of all components
- No indication of physical size

6a)

Mention of one of the following,

- Patent,
- Trademark,
- Copyright,
- Registered Design

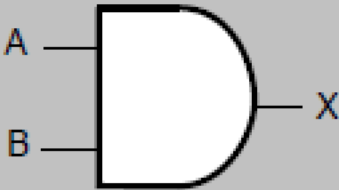


Use of term and indication of how this provides protection

6b)

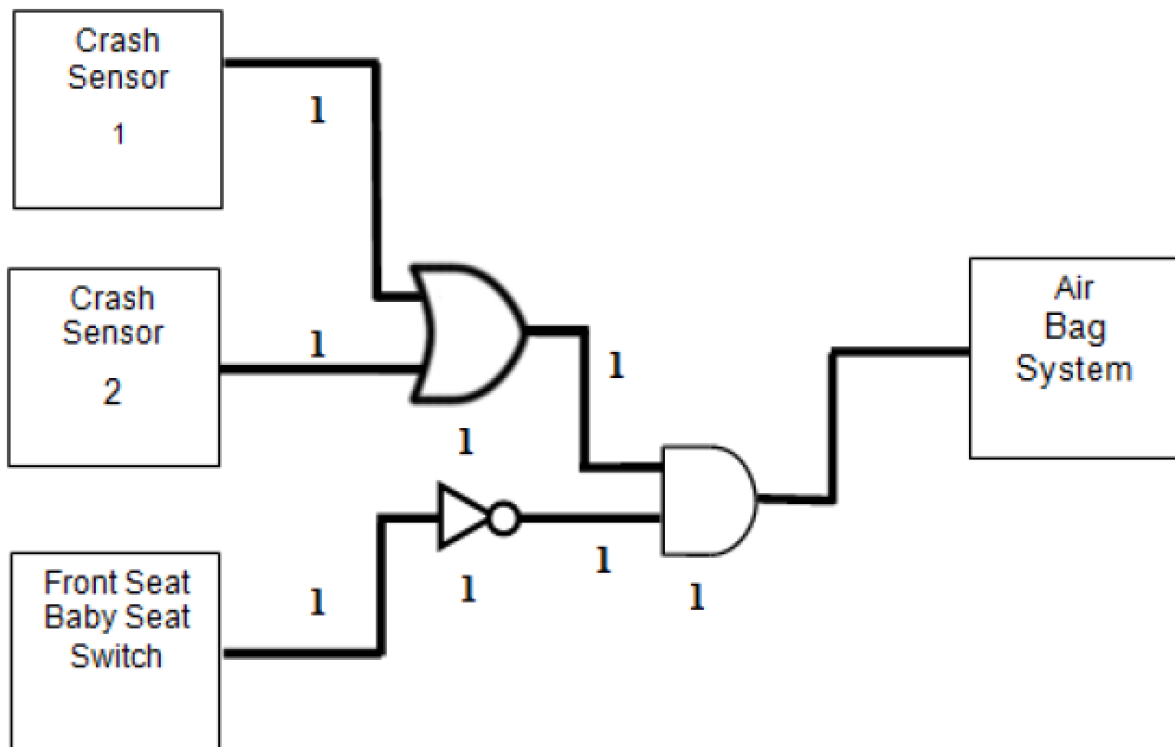
Manufacturers and Designers lose money when their goods and designs are copied or counterfeited. There is also a loss of brand quality as often the fake goods cannot be distinguished by the public from the genuine article but are often of inferior quality. Manufacturers can protect their products by taking out patents, trademarks, copyright etc, but this costs time and money to do. It also has to be done in each country that it is required to apply to. Even when protection is gained the manufacturers have to be vigilant to spot the pirated goods and then find the manufacturer and press charges. Often this involves working across international boundaries which also adds to the difficulty and cost.

Teacher's notes: I'm not an expert on Patent law. At the same time, I can make some educated remarks about it, and debate the issue a little in order to obtain 8 marks.

7a)

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7b)



7c)

