S&C GCSE June 2017 Model answer

1a)

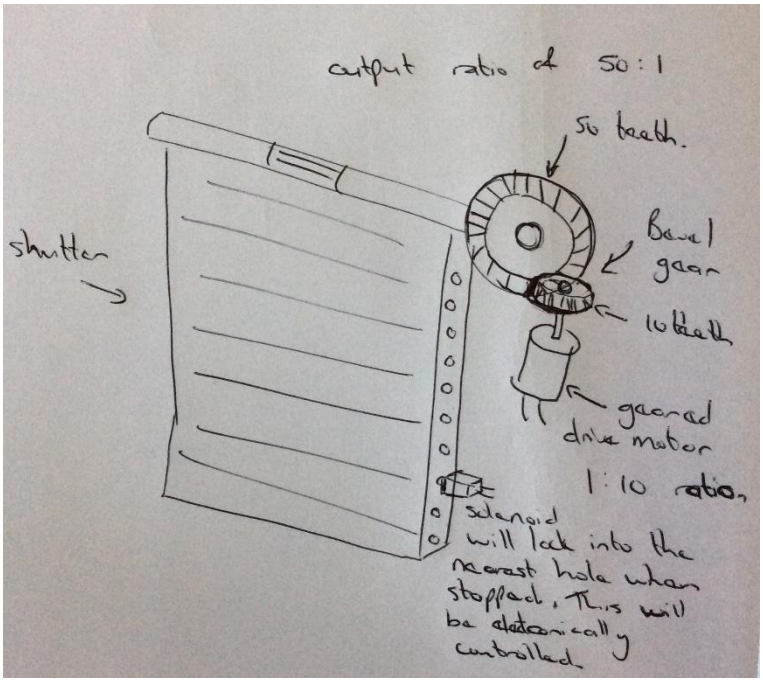
i) Rotary or Rotary Motion

ii) Linear or Linear Motion

iii) Material: Aluminium
Reason 1 and 2: Readily available, easily shaped, weather resistant, rigid, can be coated, good thermal qualities, etc.

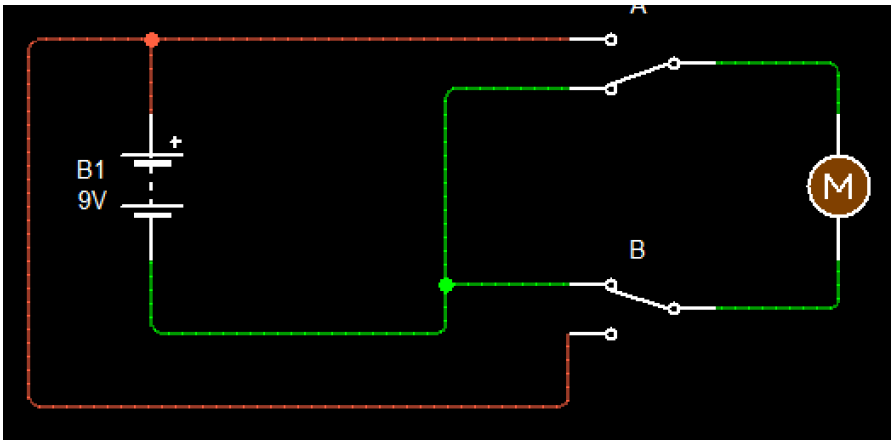
iv) Micro switch
Reason: Easily mounted

1b)

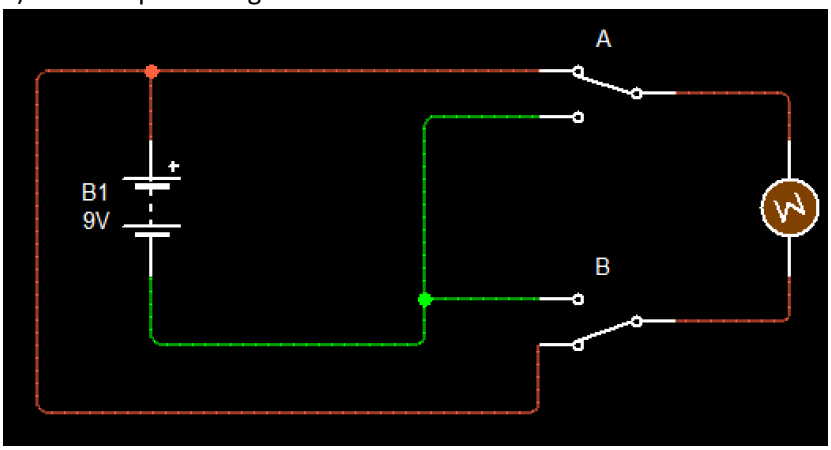


1c)

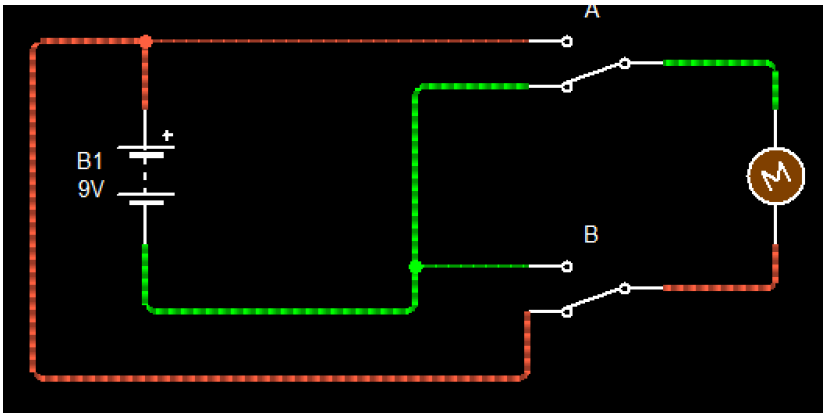
i) Stop Rotating



ii) Stop Rotating



iii) Turn Anticlockwise



1d)

When darkness falls the resistance of the LDR increases / rises the voltage at point X increases / rises and the transistor TR1 operates / activates / conducts.
Therefore, the relay coil activates / energises / magnetises / operates which activates / operates / closes the relay contacts and the lamp illuminates / operates.

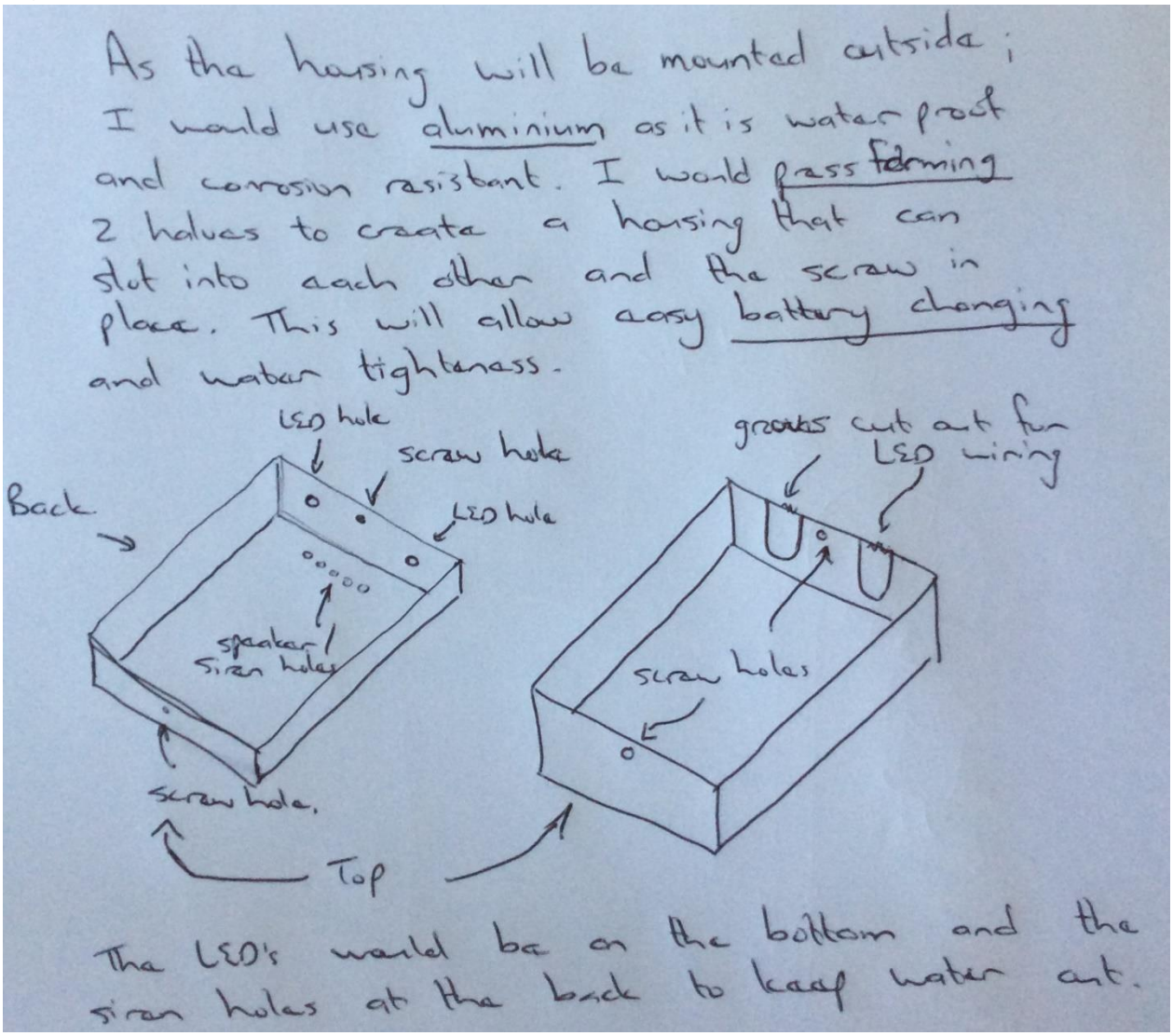
2a)

Requirement 1: Only the homeowner can switch it off (Should reference key switch or code)
Reason 1: Otherwise the intruder could stop the alarm

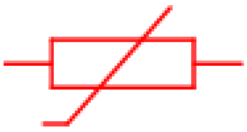
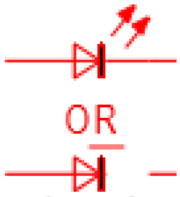
Requirement 2: It must make a loud noise.
Reason 2: So it attracts attention of neighbours

Requirement 3: Can only be set off by a person (intruder)
Reason 3: Many households have pets that might activate the alarm

2b)


As the housing will be mounted outside; I would use aluminium as it is water proof and corrosion resistant. I would pass forming 2 halves to create a housing that can slot into each other and the screw in place. This will allow easy battery changing and water tightness.
LED hole
screw hole
LED hole
Back
speaker/siren holes
screw hole.
Top
groves cut out for LED wiring
screw holes
The LED's would be on the bottom and the siren holes at the back to keep water out.

3)

Component Name	Symbol
LAMP	
Thermister **1 mark**	 **1 mark**
Diode or LED **1 mark** Accept other devices with pn junction eg Transistor	 OR **1 mark** OR symbol to match the pn Junctioned component
Solenoid **1 mark**	 **1 mark**
Capacitor **1 mark**	 **1 mark**
Microphone **1 mark**	 **1 mark**

4a)

Formula TR = R1 + R2 (or equivalent)
(The subject of the formula must be included)

Calculation

Conversion of units
5K5 = 5500ohms or 500ohms = 0.5K

Inclusion in Formula
500 + 5500 = TR or 0.5K + 5K5= TR

Answer

6000 ohms **or** 6Kohms **or** Correct addition of previous stage
(Answer must include units)

4b)

Formula V1 = R1/(R1 + R2) x Supply Voltage
(The subject of the formula must be included)

Calculation

Inclusion in Formula

V1 = 500 /(500 + 5500) x 12V

Or

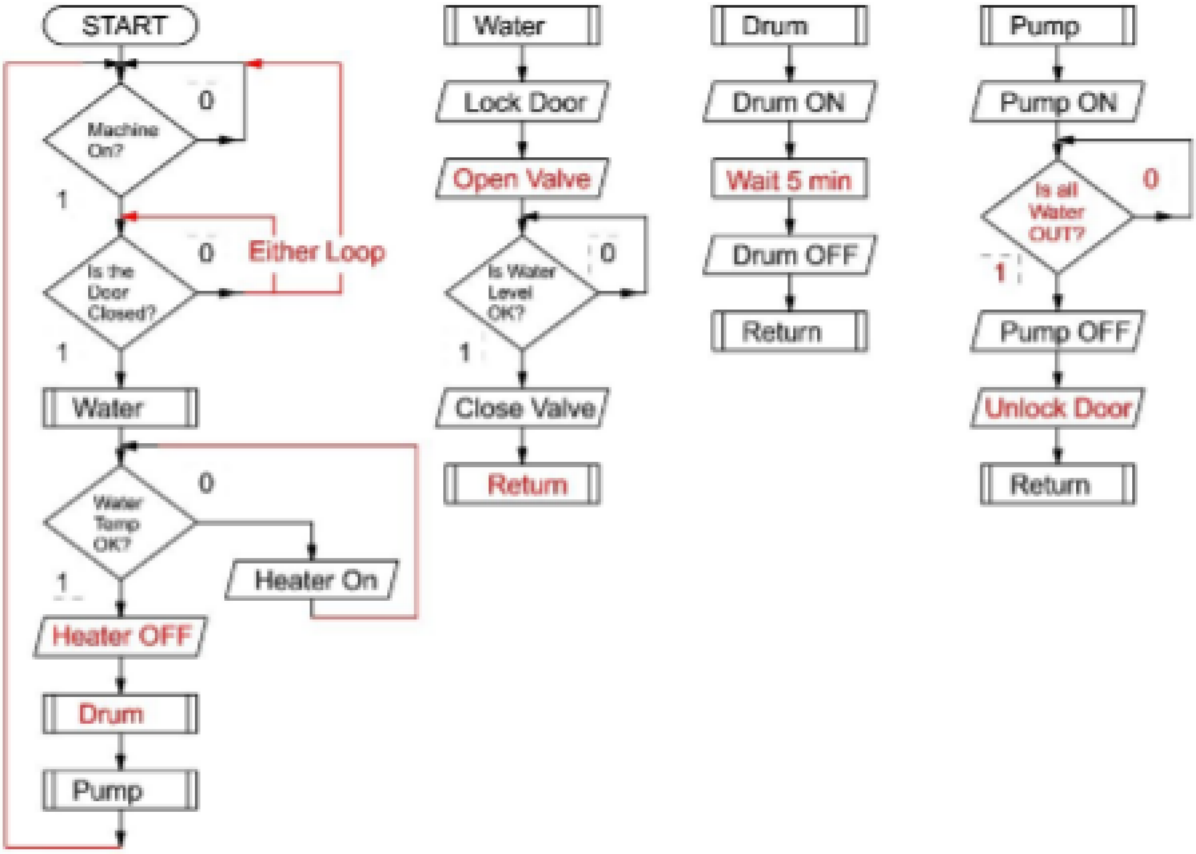
V1 = 0.5K/(0.5K + 5K5) x 12V

Conversion of units
5K5 = 5500ohms or 500ohms = 0.5K

Answer

1V or 1 volt

5a)



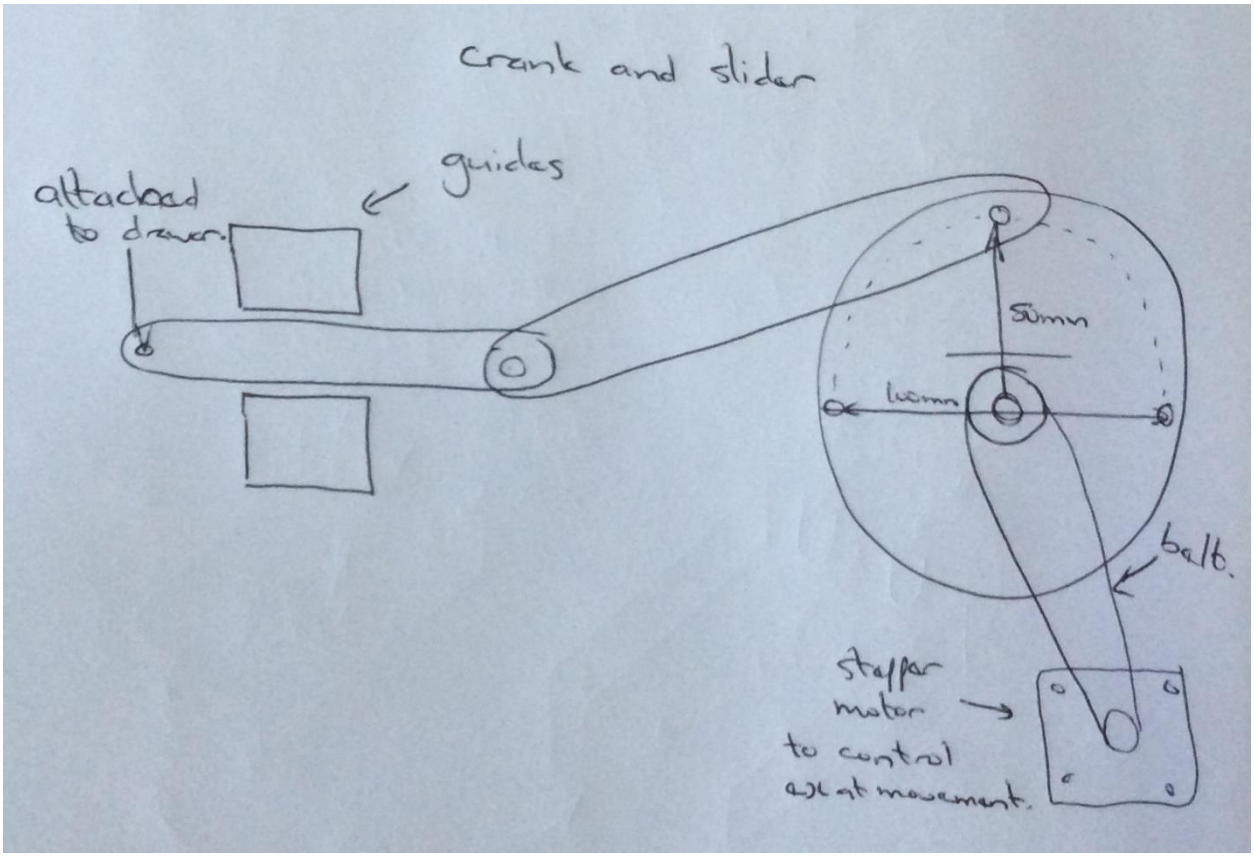
5b)

Input – Moisture meter

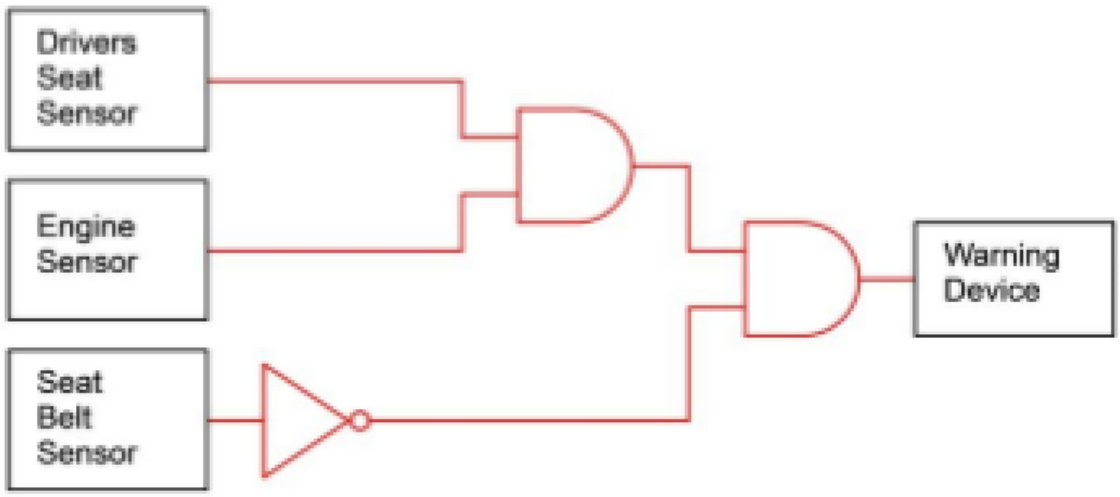
Process – Microcontroller to test the analogue value of the moisture meter and determine whether to turn on motor.

Output – Electric shut off valve for the water and Motor driver to run the motor.

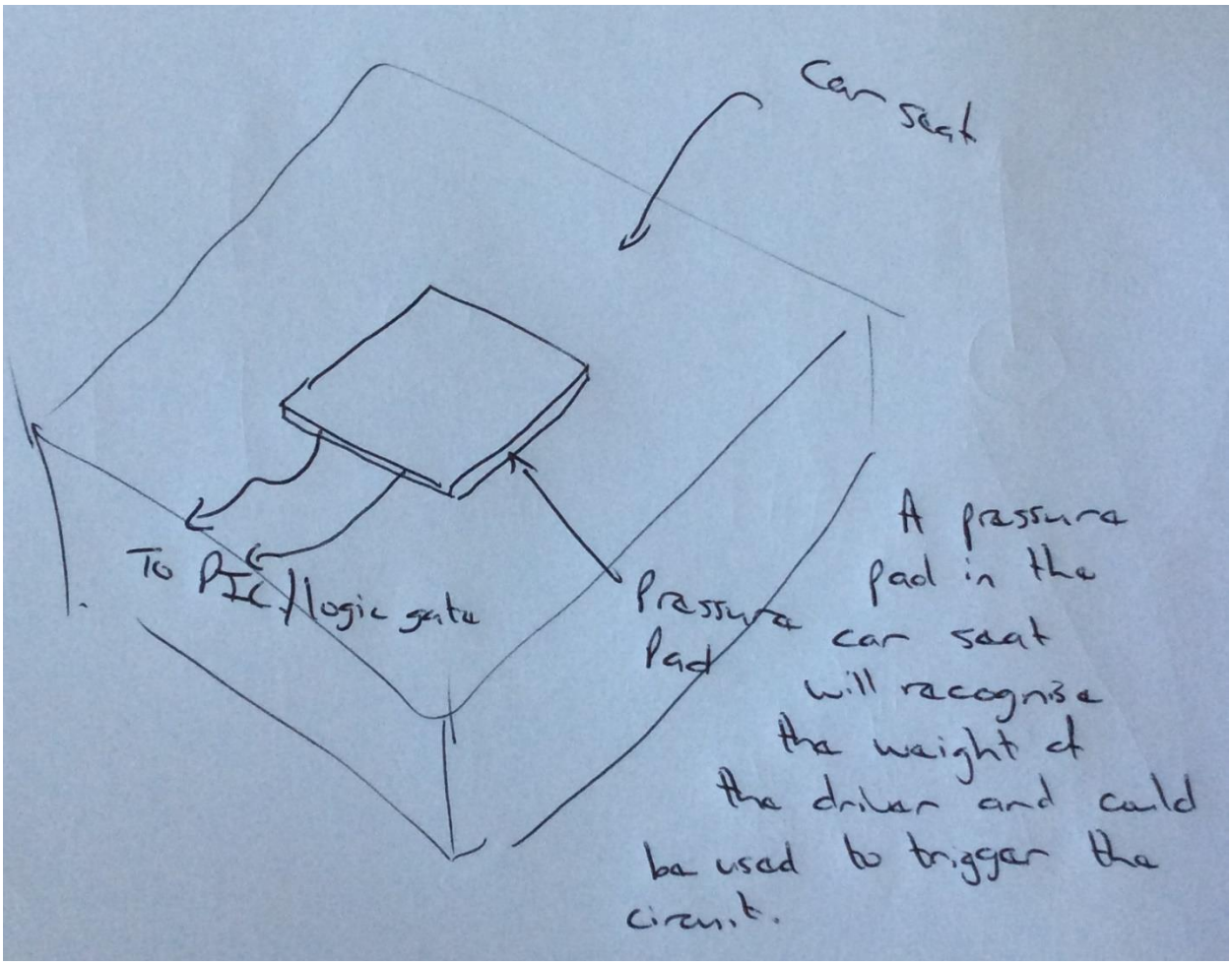
5c)


crank and slider
guides
attached to drawer.
50mm
10mm
belt.
stepper motor to control seat movement.

6a)


Drivers Seat Sensor
Engine Sensor
Seat Belt Sensor
Warning Device

6b)



6c)

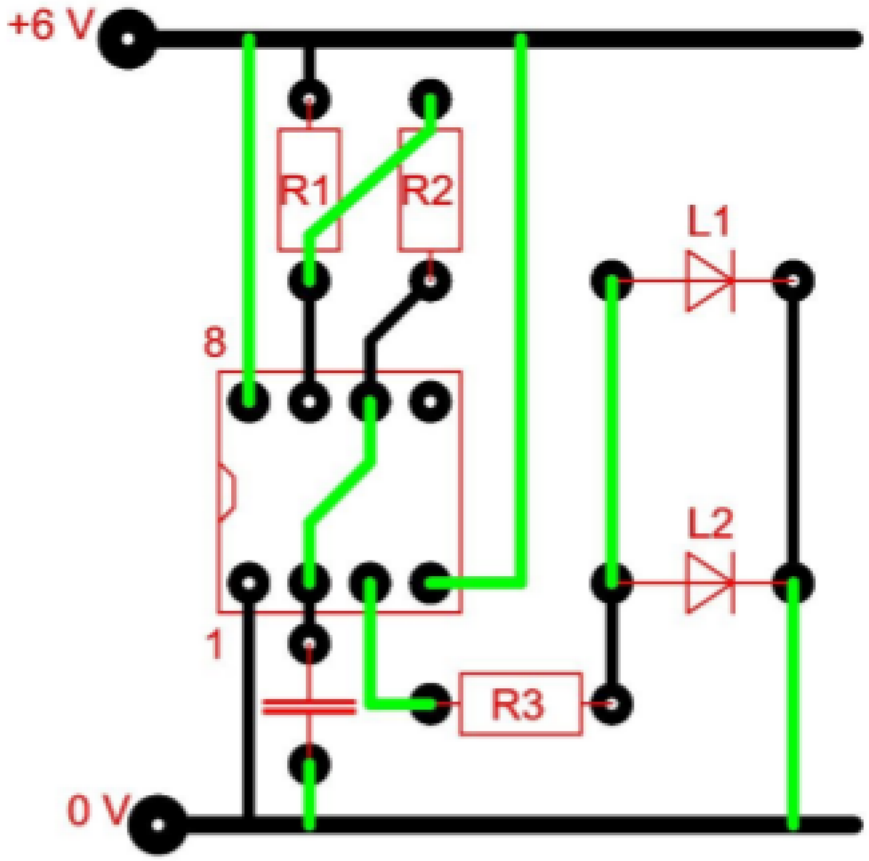
i) LED or Light Emitting Diode or Flashing LED or Flashing Light Emitting Diode or Neon or LCD or Liquid Crystal Display.

ii) Harder to ignore because it warns driver even when not looking at the dashboard.

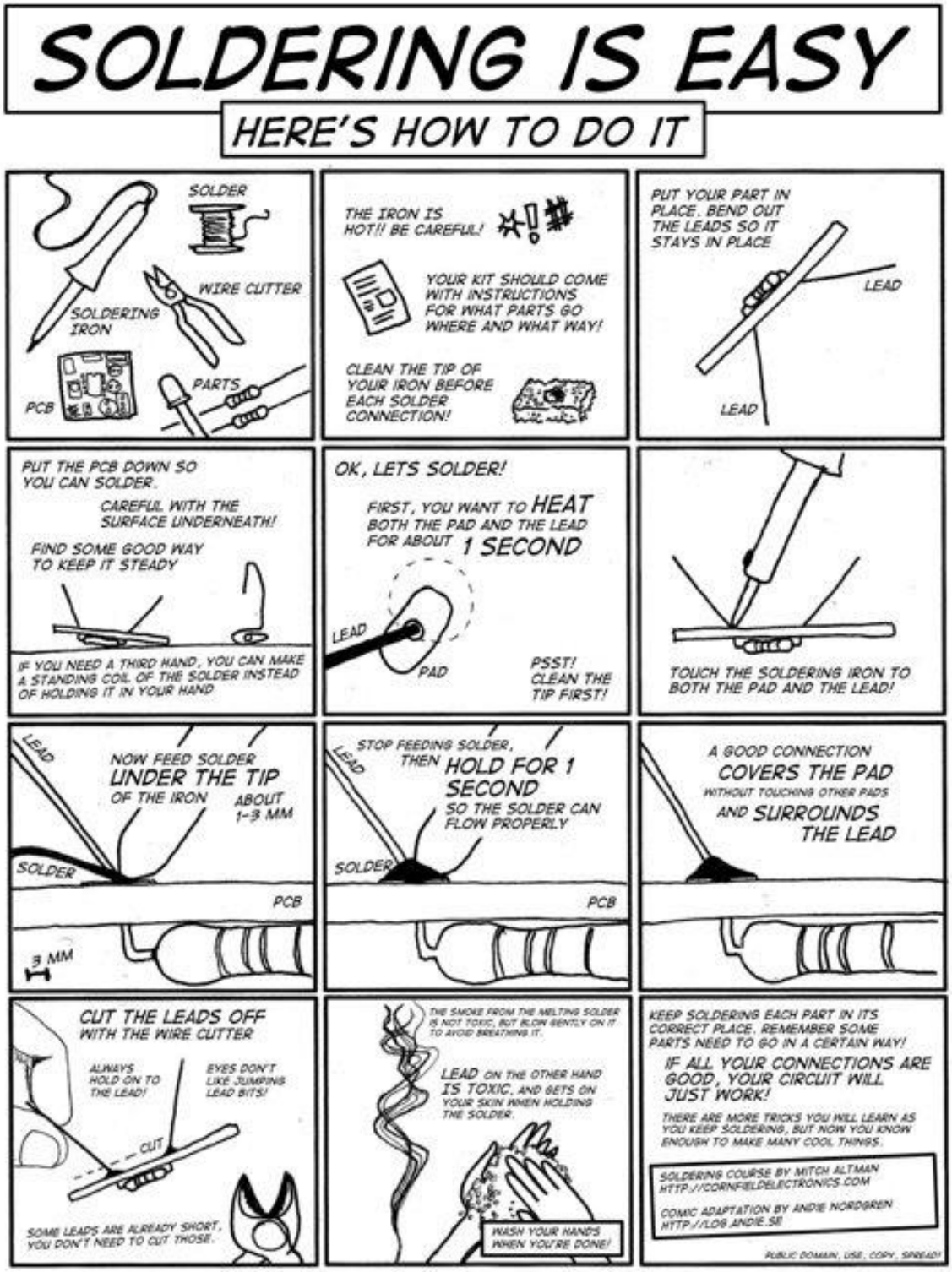
7)

Solar energy is a free and clean source of energy, it causes no pollution in the form of waste products or harmful gases. It is only available during daylight hours, collecting the energy requires large expensive systems that can cause visual pollution. The amount of energy is dependent on geographical location, time of year and weather conditions.

8a)



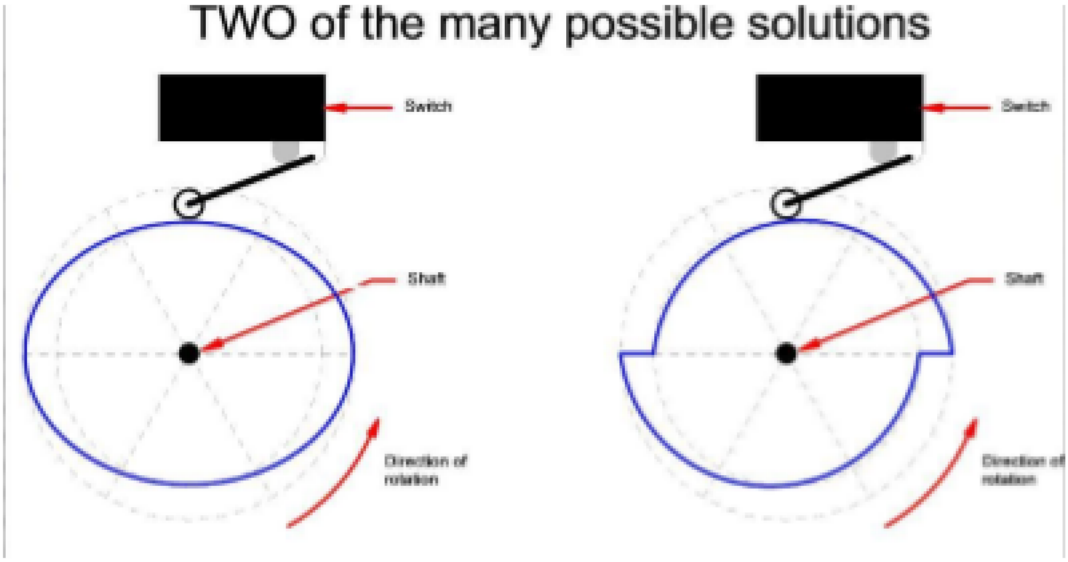
8b)


SOLDERING IS EASY
HERE'S HOW TO DO IT
SOLDER
WIRE CUTTER
SOLDERING IRON
PCB
PARTS
THE IRON IS HOT!! BE CAREFUL!
YOUR KIT SHOULD COME WITH INSTRUCTIONS FOR WHAT PARTS GO WHERE AND WHAT WAY!
CLEAN THE TIP OF YOUR IRON BEFORE EACH SOLDER CONNECTION!
PUT YOUR PART IN PLACE. BEND OUT THE LEADS SO IT STAYS IN PLACE
LEAD
LEAD
PUT THE PCB DOWN SO YOU CAN SOLDER.
CAREFUL WITH THE SURFACE UNDERNEATH!
FIND SOME GOOD WAY TO KEEP IT STEADY
IF YOU NEED A THIRD HAND, YOU CAN MAKE A STANDING COIL OF THE SOLDER INSTEAD OF HOLDING IT IN YOUR HAND
OK, LETS SOLDER!
FIRST, YOU WANT TO HEAT BOTH THE PAD AND THE LEAD FOR ABOUT 1 SECOND
LEAD
PAD
PSST! CLEAN THE TIP FIRST!
TOUCH THE SOLDERING IRON TO BOTH THE PAD AND THE LEAD!
LEAD
NOW FEED SOLDER UNDER THE TIP OF THE IRON
ABOUT 1-3 MM
SOLDER
PCB
3 MM
STOP FEEDING SOLDER, THEN HOLD FOR 1 SECOND SO THE SOLDER CAN FLOW PROPERLY
LEAD
SOLDER
PCB
A GOOD CONNECTION COVERS THE PAD WITHOUT TOUCHING OTHER PADS AND SURROUNDS THE LEAD
CUT THE LEADS OFF WITH THE WIRE CUTTER
ALWAYS HOLD ON TO THE LEAD!
EYES DON'T LIKE JUMPING LEAD BITS!
CUT
SOME LEADS ARE ALREADY SHORT, YOU DON'T NEED TO CUT THOSE.
THE SMOKE FROM THE MELTING SOLDER IS NOT TOXIC, BUT BLOW GENTLY ON IT TO AVOID BREATHING IT.
LEAD ON THE OTHER HAND IS TOXIC, AND GETS ON YOUR SKIN WHEN HOLDING THE SOLDER.
WASH YOUR HANDS WHEN YOU'RE DONE!
KEEP SOLDERING EACH PART IN ITS CORRECT PLACE. REMEMBER SOME PARTS NEED TO GO IN A CERTAIN WAY!
IF ALL YOUR CONNECTIONS ARE GOOD, YOUR CIRCUIT WILL JUST WORK!
THERE ARE MORE TRICKS YOU WILL LEARN AS YOU KEEP SOLDERING, BUT NOW YOU KNOW ENOUGH TO MAKE MANY COOL THINGS.
SOLDERING COURSE BY MITCH ALTMAN HTTP://CORNFIELDELECTRONICS.COM
COMIC ADAPTATION BY ANDIE NORDGREN HTTP://LOB.ANDIE.SE
PUBLIC DOMAIN, USE, COPY, SPREAD!

8c)

You can use a multimeter (set to test either the lowest resistance possible or continuity) to test across the joint to check there is no break in the circuit.

8d)



8e)

i)

Calculate the Velocity Ratio of the pulley system.

Formula $VR = \frac{\text{Diameter of Driven Pulley}}{\text{Diameter of Driver Pulley}}$

Calculation $\frac{20mm}{80mm}$ OR $\frac{20}{80}$ OR $\frac{1}{4}$

ii)

If Shaft A rotates at 30 rpm calculate the speed of rotation of Shaft B.

Formula Output speed = $\frac{\text{Input Speed}}{\text{Velocity Ratio}}$

Calculation

Output speed = $\frac{30}{1/4}$ OR 30 /0.25 OR 30 multiplied by 4

Answer **120 rpm** (must include units)

iii) Due to the sudden forces applied when pedaling, there is an issue of slippage when applied to a bicycle, a chain and sprocket would be better.