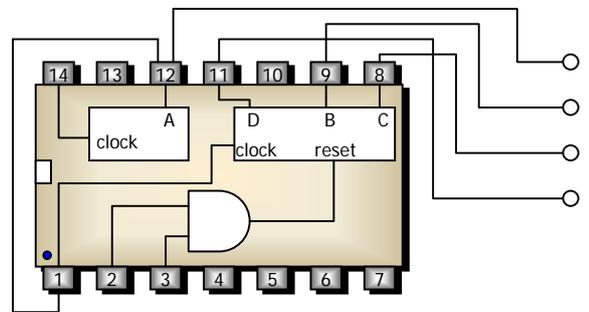
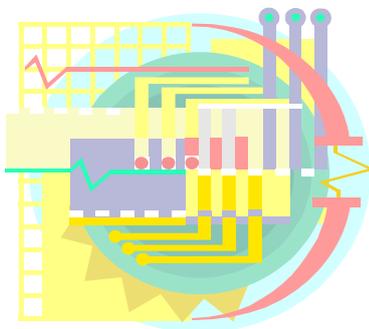


Standard Grade Physics

North Berwick High School
Physics Department

UNIT 5 ELECTRONICS PUPIL PACK



Homework Sheets

ELECTRONICS

Working at Home

TO THE PUPIL

Each day you have physics at school, you should set aside time for work at home. By this stage you should be accepting more responsibility for your own learning and should undertake the following tasks on a regular basis:

- Tackle the supplied homework sheets as each section of work is completed in class.
- Check your own progress in the homework sheets by referring to the homework answer files available in class. Discuss any difficulties that arise with your class teacher.
- Complete any formal homework tasks that your teacher may issue from time to time and hand them in on the due date for marking.
- Revise the work you have covered in class activities by referring to your classwork jotters.

TO THE PARENT

Your co-operation would be appreciated in ensuring that pupils are encouraged to complete homework. It would be helpful if you could talk over the work given for homework and sign the homework record sheet on this page after they have completed each exercise.

The physics department hopes that this record of your child's achievement will be of interest to you, and we would welcome any comments on this or other areas related to the work of the department.

Please sign here to confirm that you have seen the homework record sheet: _____

HOMEWORK RECORD SHEET

HOMEWORK	SECTION OF WORK	MARK	CHECK	PARENTAL SIGNATURE
5.1	Overview 1			
5.2	Overview 2			
5.3	Output Devices 1			
5.4	Output Devices 2			
5.5	Input Devices 1			
5.6	Input Devices 2			
5.7	Digital Processes 1			
5.8	Digital Processes 2			
5.9	Analogue Processes 1			
5.10	Analogue Processes 2			

Some questions in the pack are marked with symbols to give you specific information. Here is the key:

CR

Credit Level question. This relates directly to the Credit Level learning outcomes.

PS

Problem Solving question. This puts the knowledge you have gained into new contexts.

ELECTRONICS

Homework Exercises

Homework 5.1 - Overview I

1. (a) Name the three parts of an electronic system. (1)
(b) Draw a diagram to show how these parts are linked. (1)

-  2. (a) Street lights come on automatically when it gets dark. A light sensor detects the light level, and a voltage controlled switch turns on a lamp when it gets dark enough. Show this system in a block diagram. (3)
(b) A burglar alarm consists of a pressure pad to detect when someone treads on it connected to a bell. A voltage divider decides when the pressure is great enough to set off the alarm (this avoids small animals setting it off). Show this system in a block diagram. (3)

-  3. (a) Name the process in a radio which makes the signal stronger before the loudspeaker changes it to a sound signal. (1)
(b) What part of a radio is the input? (1)

Total 10 marks

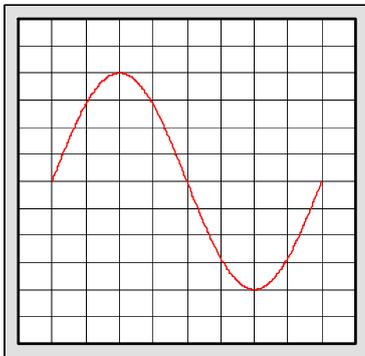
ELECTRONICS

Homework Exercises

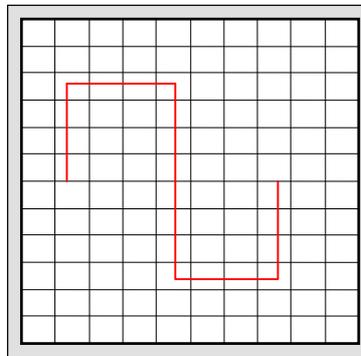
Homework 5.2 - Overview II

1. Study these two oscilloscope screens.

A



B



(a) State which one represents an analogue output and which a digital output. (1)

(b) Explain your answer to part (a). (2)

2. Make a table with two columns headed **Analogue** and **Digital**. Place the following electronic devices into one of the two columns: (4)

mercury thermometer; electronic thermometer; computer; cassette recorder; radio; clockwork watch; moving-coil meter; video timer.

- PS** 3. What is the difference between an analogue watch and a digital watch? (2)

- PS** 4. CD players, hi-fi units and televisions all have amplifiers in them. The amplifier is a process device used to add energy to the input signal before it is output as sound. (1)

Is an amplifier an analogue or a digital process?

Total 10 marks

ELECTRONICS

Homework Exercises

Homework 5.3 – Output Devices I

1. Copy and complete the following table:

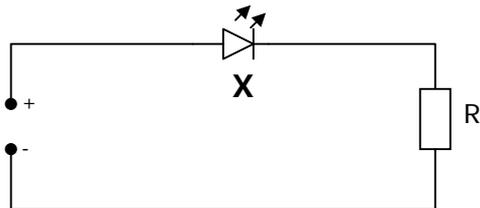
(5)

OUTPUT DEVICE	ENERGY CHANGE	SYMBOL
	Electrical →	⊗
Motor	Electrical →	
	Electrical →	🔊
Solenoid	Electrical →	
	Electrical →	🔌

2. For each of the devices mentioned in the table above, state whether it is an analogue output or a digital output.

(2½)

3.



(a) Name the component marked **X** in the circuit.

(½)

(b) What would happen in the circuit if component **X** was connected the opposite way around?

(1)

(c) Why must there always be a resistor in series with this component?

(1)

Total 10 marks

ELECTRONICS

Homework Exercises

Homework 5.4 – Output Devices II

CR

1. An LED is attached to a 6 V supply. An excerpt from its data sheet is given below:

Maximum forward voltage: 2.7 V
Maximum forward current: 110 mA

- (a) Draw a circuit diagram that will allow this LED to light safely. (3)
(b) Calculate the value of the resistor needed. (3)
2. (a) Why is a seven-segment display so-called? (1)
(b) Draw the numbers (i) 3; (ii) 9 as they'd appear on a seven-segment display. (1)
(c) What range of numbers can be displayed on a single seven-segment display? (1)

CR

3. What is the decimal equivalent of the binary number 0110? (1)

Total 10 marks

ELECTRONICS

Homework Exercises

Homework 5.5 – Input Devices I

1. Copy and complete the following table: (2)

INPUT DEVICE	ENERGY CHANGE
solar cell	→
	heat → electrical
microphone	→

2. Sketch a graph to show how the resistance of an LDR might vary with light intensity. (2)

PS

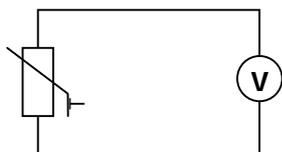
3. A thermistor is placed in a beaker of water and its resistance measured with an ohmmeter at various temperatures. The following results are obtained:

TEMPERATURE(°C)	RESISTANCE (Ω)
0	980
10	600
20	375
30	300
40	240
50	160
60	108
70	75
80	53

- (a) What is the resistance of the thermistor at 30 °C? (1)
 (b) If the thermistor was connected to a 6V battery, how much current would flow through it at 30 °C? (2)

PS

4. A girl decides to find out how a thermistor could be used to investigate temperature changes. She sets up the following circuit:



- (a) Suggest why this circuit is not suitable for her purpose. (1)
 (b) Explain how she could change the circuit, and redraw the amended version. (2)

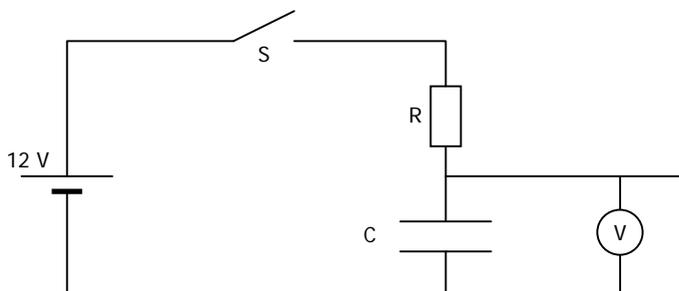
Total 10 marks

ELECTRONICS

Homework Exercises

Homework 5.6 – Input Devices II

1. Look at the following circuit. Capacitor **C** is initially discharged. Switch **S** is now closed



- (a) What will the voltmeter read before the switch is closed? (1)
- (b) What happens to the voltage as time goes on after the switch is closed? (1)
- (c) State two changes that could be made to this circuit which would decrease the time taken for the capacitor to fully charge up. (1)

CR

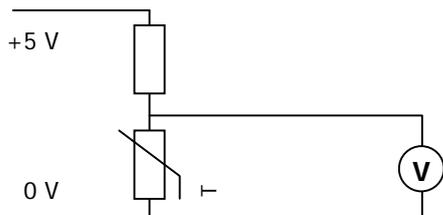
2. Use the following list of input devices to choose the most appropriate input for the following systems: (2)

microphone; thermocouple; solar cell; LDR; switch; voltage divider; capacitor; thermistor.

- (a) Karaoke machine
 (b) Automatic camera flash
 (c) Temperature control in a fish tank
 (d) Time delay switch on a burglar alarm

CR

3. The circuit shown below was set up. The thermistor used has its resistance vary with temperature as show in the table. The fixed resistor has a value of $1000\ \Omega$.



TEMPERATURE ($^{\circ}\text{C}$)	RESISTANCE (Ω)
20	1000
50	700
100	100

- (a) What is the reading on the voltmeter at room temperature ($20\ ^{\circ}\text{C}$)? (3)
- (b) The thermistor is now heated to $100\ ^{\circ}\text{C}$. Calculate the new reading on the voltmeter. (2)

Total 10 marks

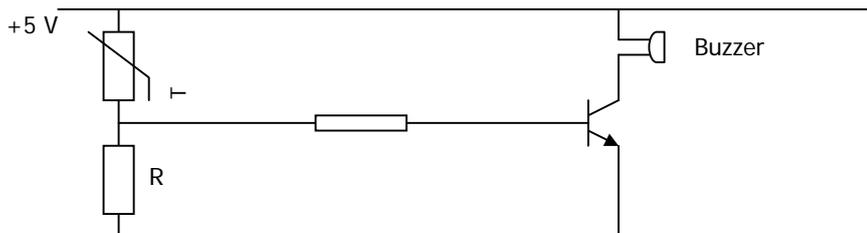
ELECTRONICS

Homework Exercises

Homework 5.7 – Digital Processes I

1. (a) Draw the circuit symbol for a transistor. (1)
- (b) Give one use for a transistor in an electronic circuit. (1)

2. The circuit shown below is used as an alarm.

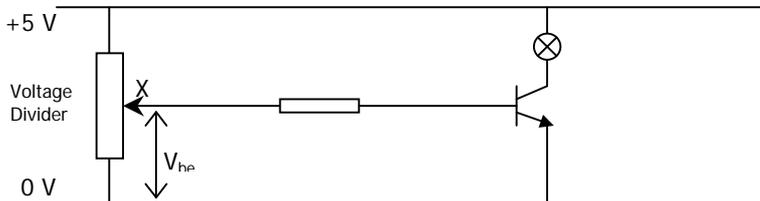


- (a) The thermistor is positioned in a car engine. At normal engine temperatures, the transistor is OFF. What will happen if the engine overheats? (1)
- (b) Explain how the circuit works. (2)

CR

PS

3. A transistor will switch on when a voltage is applied between the base and the emitter. An experiment is set up to investigate this as shown.



- If the transistor is just at the point of switching on, in which direction will the sliding contact X have to be moved in order to switch it on? Explain your answer. (2)

4. (a) Draw the circuit symbols for an **AND** gate, an **OR** gate, and a **NOT** gate. (1½)
- (b) Draw the truth table for each of these - remember to mark which is which! (1½)

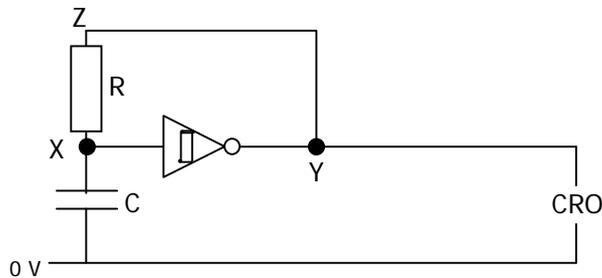
Total 10 marks

ELECTRONICS

Homework Exercises

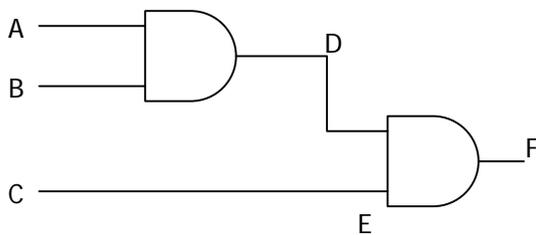
Homework 5.8 – Digital Processes II

The circuit shown below is used to produce a series of pulses. Questions 1 and 2 both refer to it.



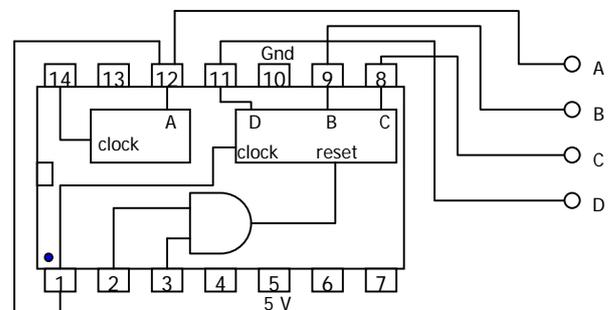
1. (a) Draw what will be seen on the oscilloscope screen (no numbers are necessary!) (1)
 - (b) On the same diagram, use a different colour to draw what would be seen if there were more pulses produced each second. (1)
- CR**
2. (a) If you wanted more pulses each second, what two things could be altered in the circuit? (1)
 - (b) If the capacitor is initially discharged, what is the voltage at **X**? (½)
 - (c) What logic level does this represent? (½)
 - (d) What will the logic level at **Y** be? (½)
 - (e) What voltage does this produce at **Z**? (½)

- CR**
3. Look at the following circuit and then complete its truth table: (2)



A	B	C	D	E	F
0	0	0			
0	1	0			
1	0	0			
1	1	0			
0	0	1			
0	1	1			
1	0	1			
1	1	1			

- PS**
4. The diagram to the right shows the pin configuration for a 7493 integrated circuit, which is the basis for many counting circuits. Its outputs D, C, B and A will represent a binary number provided pin 12 is connected to pin 1 (as shown). No other connection should be made to pin 1.



- (a) To which two pins should a reset signal be applied? (1)
- (b) If the counter resets every 5th pulse, which two pins have been connected to the reset pins? Explain your answer. (2)

Total 10 marks

ELECTRONICS

Homework Exercises

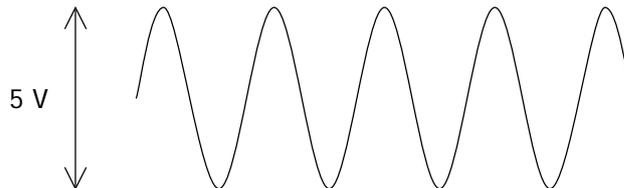
Homework 5.9 – Analogue Processes I

1. Using the list below, choose the devices that contain an amplifier: (2)
television; radio; microwave oven; compact disc player; baby alarm; fridge; kettle; lamp.

2. (a) In a stereo, what does an amplifier do to the electrical signal? (1)
(b) Where does the amplifier get the energy to do this? (1)
(c) What wave property must the amplifier not affect? (1)

3. (a) What are the units of voltage gain? (careful!) (1)
(b) State the equation used to calculate voltage gain. (1)
(c) A baby alarm inputs a 0.01V voltage to an amplifier when a baby is crying, and the output voltage is 1V . Use the above equation to calculate the voltage gain of this amplifier. (1)

4. PS A small amplifier in a physics lab has a voltage gain of 3. The following wave is fed to the amplifier from a signal generator. Calculate the output voltage from the amplifier, and draw the signal to the same scale. (2)



Total 10 marks

ELECTRONICS

Homework Exercises

Homework 5.10 – Analogue Processes II

CR 1. Describe a method for measuring the voltage gain of an amplifier. You must name all equipment used, state what measurements are made and explain what calculations would have to be done. (3)

CR 2. Copy and complete the following table. You must do full working for each problem. (4)

VOLTAGE (V)	POWER (W)	RESISTANCE (Ω)
230		2000
12		24
50	25	
	14.4	10

CR 3. A power amplifier boosts a 0.5 W signal to 15 W. Calculate the power gain. (1)

CR 4. A small stereo has a power output of 30W. Its amplifier is rated as having a power gain of 1000. Calculate the size of the input power. (2)



Total 10 marks