HEATHCOTE SCHOOL

A LEVEL PHYSICS

TRANSITION UNIT

Bridging the gap between GCSE and AS-Level

Name: _____

Secondary School _____

Contents

Introduction

Some students find the transition from GCSE to A-level Physics very challenging. To help make this transition smoother and to give you the best possible start, we have prepared this booklet for you.

It is important that you read through this booklet and then complete all the questions. If you require more space then you can use lined paper. Many of the topics are GCSE topics which you should have already covered. You will need secure knowledge of these topics before you start the course in September. In addition to this there are questions that require you to research a topic so that you become familiar with new vocabulary and concepts.

At the beginning of the course you will be given a test to check how well you have understood the topics. If you do not pass this test, you will be put into an intervention class. This class will help you to bring your knowledge and understanding up to the required standard.

To help you complete this booklet the following resources may be useful:

- Head Start to AS Physics Published by CGP
- http://www.bbc.co.uk/schools/gcsebitesize/
- http://www.s-cool.co.uk/gcse

Dr Barard

Course outline

The study units

AS Level			
Unit:	Title:	Assessment:	
1	Particles, Quantum Phenomena and Electricity	75 min exam	20%
2	Mechanics, Materials and Waves	75 min exam	20%
3	Investigative and practical skills	75 min exam based on practical activity	10%
A2			
4	Fields and further mechanics	105 min exam	20%
5	Nuclear and thermal physics plus option A - D	105 min exam	20%
6		75 min exam based on practical activity	10%

AS + A2 = A Level

Structure of lessons

There will be 5 timetabled lessons each week. You will be required to actively participate in lessons by asking and answering questions, contributing and sharing ideas.

Assessment

Assessment will take place:

1. During lessons
2. At the end of a topic
3. At the end of a unit

Any assessment will test for knowledge, understanding, application skills, analysis skills and evaluation skills.

Homework

You will be given homework on a regular basis, which must be completed in addition to reading around the subject and note making.

Resources

- Main textbook: Nelson Thornes AQA AS Physics
- Other texts: CGP AS Physics textbook
- AQA website
- http://www.iop.org

Unit 3 Investigative and practical skills in AS Physics

This unit will address the following aspects of the AS subject criteria. The ability to:

1. demonstrate and describe ethical, safe and skilful practical techniques, selecting appropriate qualitative and quantitative methods
2. make, record and communicate reliable and valid observations and measurements with appropriate precision and accuracy
3. analyse, interpret, explain and evaluate the methodology, results and impact of their own and others' experimental and investigatory activities in a variety of ways.

This unit involves a practical exam and a written test paper. An example of the paper and the mark scheme can be found on the AQA website. This unit is called 3T.

http://www.aqa.org.uk/subjects/science/a-level/physics-a-2450/past-papers-and-mark-schemes

Task 1: Scale

1 Put these objects in order of size, starting with the smallest first

Star, nucleus, atom, planet, electron, galaxy, molecule

……electron……, ……nucleus……., ……atom……..,

……molecule……, ……planet……., ……star……..,

……galaxy……..

2. What is nanoscience?

…Study of a structure or particles that are in the order of 10^{-9}m thick. To give you an idea how small the nanoscale is, one nanometer (nm) is one billionth of a meter (1 meter divided by a billion). For comparison, a human hair is around 80,000nm thick. This page is around 75, 000nm thick. Nanoparticles have many useful characteristics. They may improve the strength, chemical structure, or electrical and thermal conductivity of different materials. Scientists and engineers from use nanoscience principles for advanced applications in energy, medicine, information storage, computing and elsewhere.
……
……
……
……

3. Complete the following table which gives information on prefixes that are used to denote the quantity of something. The first one has been done for you

Prefix	**Quantity**	**Power of ten**
Kilo	1000	10^{3}
Mega	1000,000	10^{6}
Giga	1000, 000, 000	10^{9}
Milli	0.001	10^{-3}
Micro	0.000001	10^{-6}
nano	0.000000001	10^{-9}

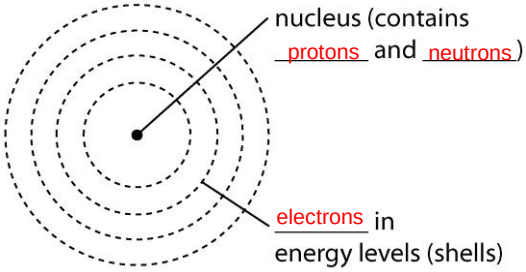
Pico	0.000000000001	10^{-12}
Femto	0.000000000000001	10^{-15}

Task 2: Atoms and Ions

1 Complete the spaces to create a set of notes about the structure of atoms.

Atoms consist of a central _____nucleus_____ containing protons and _____neutrons_____. The nucleus is _____small_____ compared to the size of the whole atom. The nucleus is surrounded by _____electrons_____ in energy levels (also called _____shells_____). Atoms have no electric charge because they contain the same number of protons and ____electrons_____.

Sub-atomic particle	Relative mass	Relative charge
Proton	1	+1
Neutron	1	0
Electron	0	-1



Atomic number = number of ____protons_____.

Mass number = number of _____neutrons_____ + number of _____protons_____.

mass number **19**

Symbol e.g. **F**

atomic number **9**

protons = 9

neutrons = 10

electrons = 9

Atoms of the same element have the same number of _____protons_____. It is the number of _____neutrons_____ that determines what type of atom it is (e.g. all atoms with six protons are carbon atoms). Atoms of different elements have different numbers of _____protons_____. Isotopes are atoms of the same element. They contain the same number of _____protons_____ but a different number of _____neutrons_____.

2 Complete the table about some atoms.

Atom	Atomic number	Mass number	Number of protons	Number of neutrons	Number of electrons
$^{23}_{11}Na$	11	23	11	12	11

Li	3	7	3	4	3
Ar	18	40	18	22	18
K	19	39	19	20	19
$^{235}_{92}U$	92	235	92	143	92
$^{238}_{92}U$	92	233	92	141	92

Task 3: Research Task

Visit the following website: **http://home.web.cern.ch/**

Click on the 'Students & Educators' tab and scroll down the 'Students' section and write in the space provided below something interesting that you learned. You may use a separate sheet if you wish to do so.

Any sensible answer mentioning the use of accelerators and experiments that have been or, are currently being carried out at CERN.

Task 4: Wave equations

Wave speed can be calculated using the following equation

$$\text{Wave speed } (v) = \text{frequency } (f) \times \text{wavelength } (\lambda)$$

1. What speed do all electromagnetic waves travel in a vacuum?

……3x10^{8}m/s……

2.

i. A water wave has a frequency of 2Hz and a wavelength of 0.3m. How fast is it moving?

0.6m/s

II. A water wave travels through a pond with a speed of 1m/s and a frequency of 5Hz. What is the wavelength of the waves?

0.2m

III. The speed of sound is 340m/s (in air). When Dave hears this sound his ear vibrates 660 times a second. What was the wavelength of the sound?

0.5m

IV. Purple light has a wavelength of around $6x10^{-7}$m and a frequency of $5x10^{14}$Hz. What is the speed of purple light?

$3x10^{8}$m/s

3. What are the two types of waves?

Longitudinal…….. and Transverse…….. waves.

4. What is meant by diffraction and refraction?

Diffraction

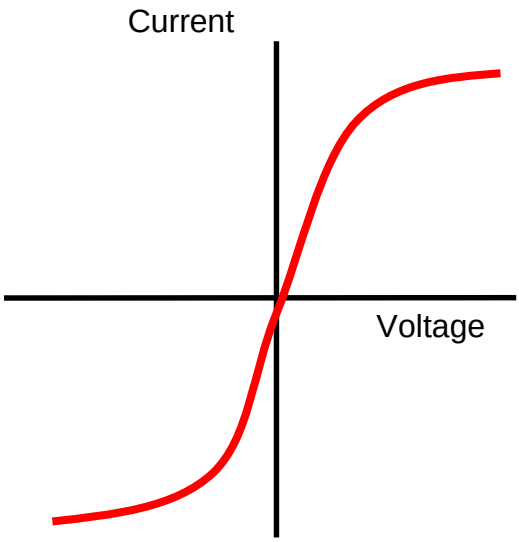
When a wave changes direction when it comes across a barrier or spreads out when it passes through a gap……..……..……..……..……..……

Refraction

The process when light will speed up or slow down depending on whether it enters a less dense or more dense mediums

Task 5: Resistance

1. Draw a graph of voltage against current for a bulb



2. How does the length of wire affect its resistance?

Resistance is proportional to length. The longer the wire, the greater the resistance.

3. In a circuit the voltage across a component is 10V and the current through it is 2 amps, what is the resistance?

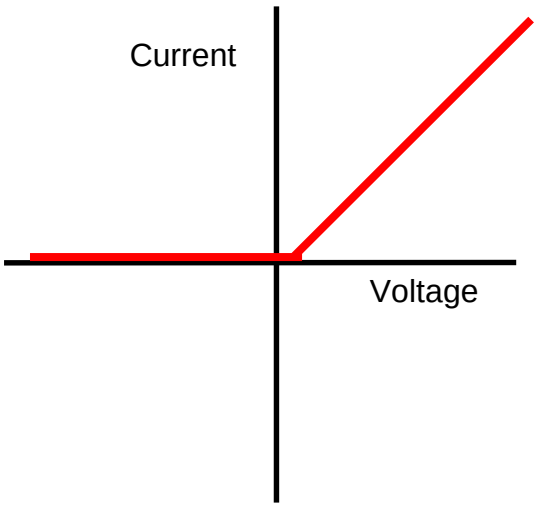
V=IR

R=V/I

R=10/2

Answer…5 ohms……..

4. Draw a graph of voltage against current for a diode



5. What are the units of voltage, current and resistance?

Voltage ……volts (V) …

Current ……amps (A)…...

Resistance …ohms (Ω)……..

6. What device do we use to measure current and what is its symbol?

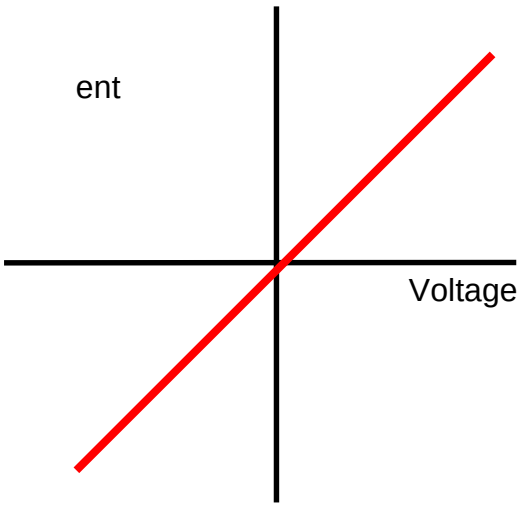
Ammeter

Symbol is

7. How does the thickness of a wire affect its resistance?

Resistance is inversely proportional to the cross section of a wire. The thicker the wire, the larger the cross section. This will result in a decrease of resistance.

8. Draw a graph of voltage against current for a resistor



Current increases in proportion to voltage

9.

a) What is the formula connecting resistance, current and voltage?

R=V/I

b) What is the resistance of the following:

I. A bulb with a voltage of 3V and a current of 1A.

3 Ω

II. A resistor with a voltage of 12V and a current of 3A

4 Ω

III. A diode with a voltage of 240V and a current of 40A

60 Ω

IV. A thermistor with a current of 0.5A and a voltage of 10V

20 Ω

10. Current is the rate of flow of charge (how much charge flows in a certain time). This means one amp is equal to one coulomb of charge passing a point every second.

a) What formula links these variables together?

I=Q/t

b) 10 C of charge passes a point in 5 seconds, what is the current?

I=10C/5s

I=2A

Task 6: Electrical circuits

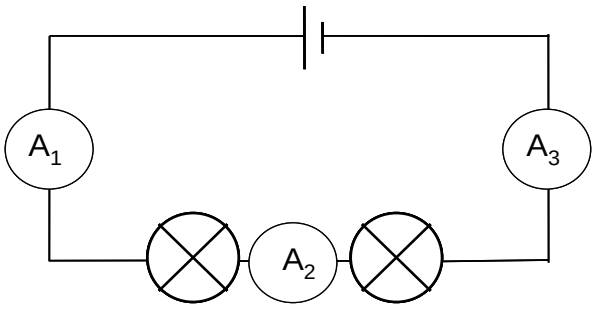
1. Potential difference is measured in __volts__ which has the symbol __V__

To measure potential difference you use a __voltmeter_____.

The voltmeter must be connected in __parallel___ with the component

2. An ammeter is always connected in series.

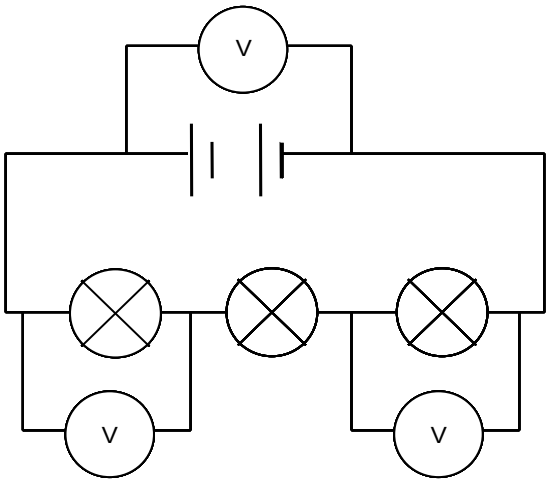
a) If A_1 reads 2A, what will A_2 and A_3 read?



ANSWER: A_2 ……2A…….. and A_3 ……2A……..

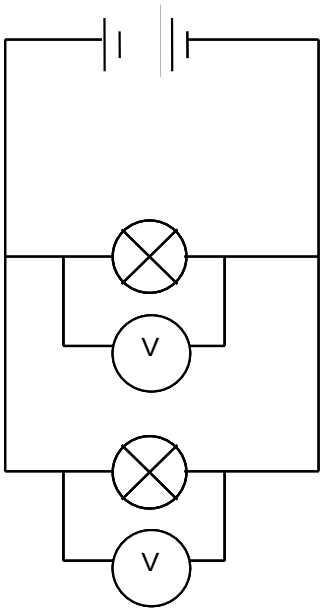
b) If the potential difference across the battery is 6V and all bulbs are identical, what will the potential difference (voltage) across each bulb (lamp) be?

ANSWER: ……2…….. Volts



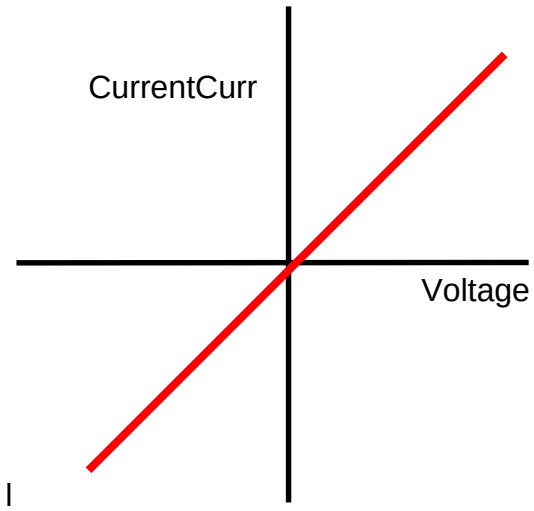
c) If the potential difference across the battery is 4V and all bulbs are identical, what will the potential difference (voltage) across each bulb be?

ANSWER: ……4…….. Volts

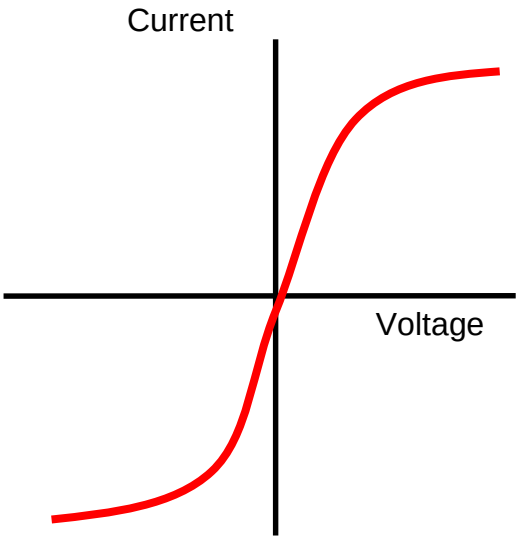


Task 7: Current-Potential difference graphs

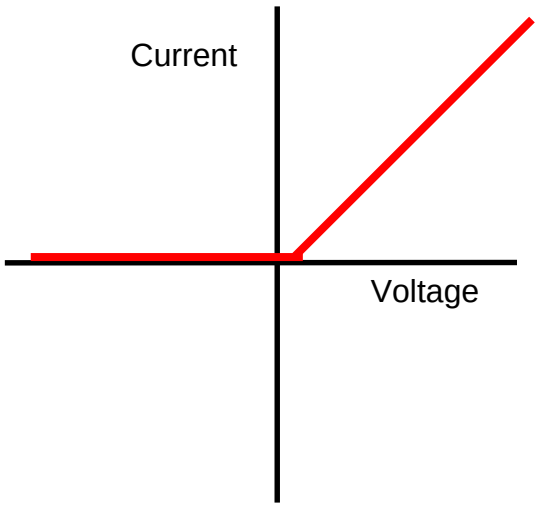
1. Draw the current-voltage graphs for a resistor at constant temperature



2. Draw the current-voltage graphs for a bulb (filament lamp)



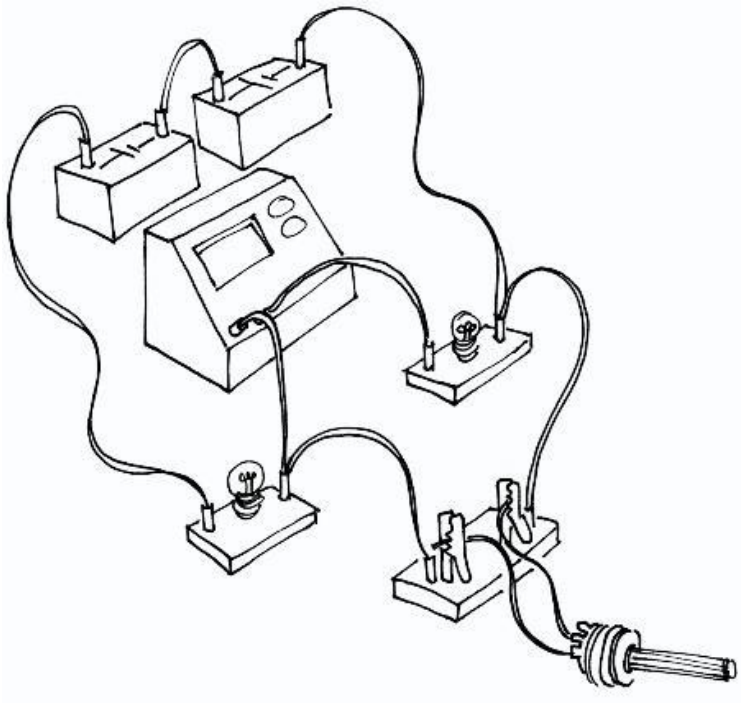
3. Draw the current-voltage graphs for a diode



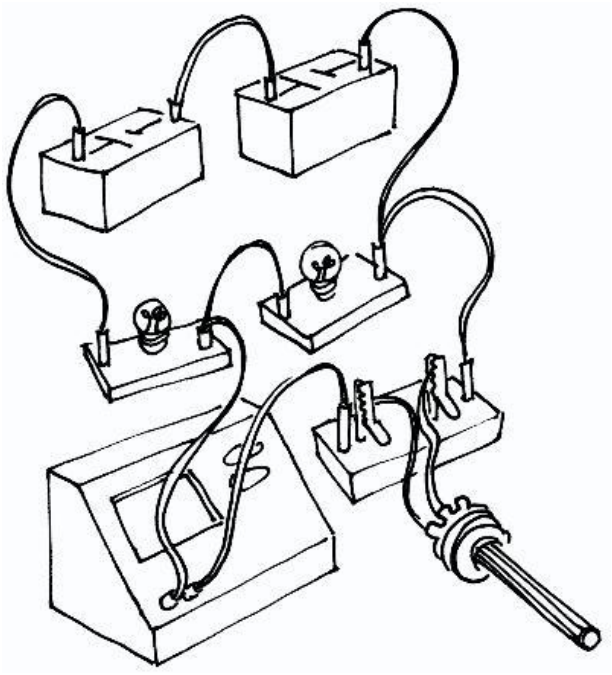
Task 8: Circuit diagram extension

Draw the circuit diagrams for both set-ups below

a)



b)



c) Compare both circuits and write your comments below

Students should be able to notice that there are two batteries and two bulbs connected in series and are connected to a variable resistor. There is also an ammeter connected in series.

Variable resistors have a resistive element connected to two terminals and have a slider connected to a third terminal. As you move the slider, the resistance increases or decreases along the way. They are useful for brightness control, allowing the bulbs to alternate from dim to bright. This is attributed to the fact that electric current will have to travel through a certain length of the strip depending where the slider is. As electricity travel through a longer path, it will encounter more resistance.