*E-LEARNING + WRITE-ON = SUCCESS*

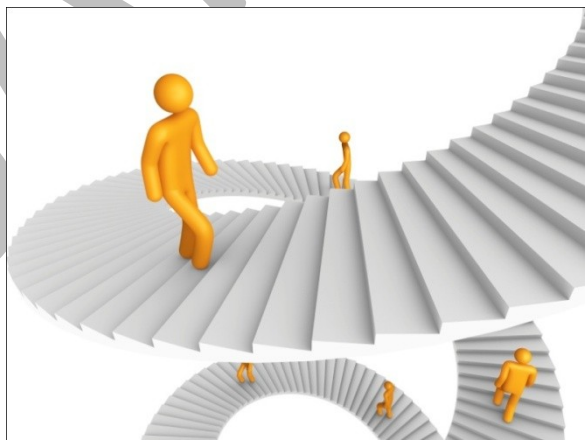
# NCEA SCIENCE LEVEL 1

## AS 90940 - 1.1
## Demonstrate understanding of aspects of Mechanics

Revision Workbook

+

Interactive Web-based Learning



Trevor Castle

www.livewirelearning.co.nz



## Introduction

Trevor Castle is the Physics author for the Pathfinder Science series of text books. He was Head of Physics at Palmerston North Boys' High School where he also taught the scholarship/university class.

Live-wire Learning is New Zealand's most comprehensive on-line learning resource for secondary school students providing detailed teaching material and graded questions in Level 1 Science, Level 2 Physics, and Level 3 Physics.

Our aim with this first book in the series is provide complementary hard copy write-on notes and questions to support the on-line material so that, as a student, you get access to the best of both worlds.

As a students you can now

- read, highlight and summarise in hard copy format the detailed learning notes from the site
- go on line and use the Live-wire Learning programme to practice your knowledge and understanding of this material with Achieved level questions, gain success and confidence
- get instant feedback from the hundreds of online questions + explanations to accelerate your learning
- re-sit modules to improve your score out of 10 and 'working at' level
- extend yourself
- track your record of learning and your place on the leader board (see our home page)
- answer scaffolded, NCEA-type questions in the booklet and either self-mark or ask your teacher to mark them for you
- use the mind map template to create a visual and colourful summary to aid memorisation
- use the definitions modules to rehearse key terms
- access the write-on answers from your teacher

We hope that this resource will motivate and equip you to succeed in this subject.

For instructions to access the web site, turn to the inside back cover.

All the best for your exams.

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Live-wire Learning log in: http://my.livewirelearning.co.nz

Learning Outcomes indicate the scope of the content

Achievement Standard Physics 1.1

Demonstrate understanding of aspects of mechanics

By the end of this module you should be able to:

1. *Define distance.*
2. *State the SI unit of distance and its symbol.*
3. *Convert non SI units such as "feet and inches" into SI units.*
4. *Recognise metric units in metric prefix form.*
5. *Make straight line measurements using a simple scale such as a ruler.*
6. *Read information from a distance-time graph.*
7. *Read distance information from scale map and calculate distances between two points.*

# Motion and Distance

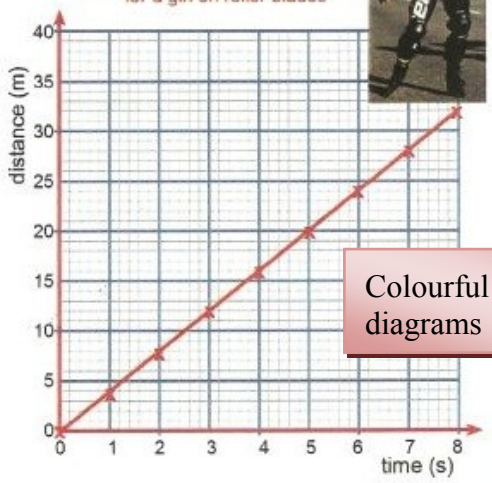
## A Measurement of Distance in New Zealand

Detailed, succinct summary notes from online module.

**1 Distance** *is how far an object has travelled.*

- Its SI (standard) unit is the metre, (unit symbol m).
- In New Zealand, distance is usually measured in:
  - millimetres, (unit symbol mm)
  - kilometres (unit symbol km)
- 1 mm = 0.001 m
- 1000 mm = 1 m
- 1 m = 0.001 km
- 1000 m = 1 km

Figure 1: Distance versus time graph for a girl on roller blades




Colourful charts and diagrams

**2** Figure 1 shows a graph which describes a journey for a girl on roller blades, lasting 8 seconds (s) and travelling a distance of 32 metres (m). The graph can be used to work out how far she has travelled in a certain time.

For example:

- After 4 s she has travelled a distance 16 m.
- She has travelled a distance of 24 m after a time of 6 s.

**3 Practical Use**

Figure 2 shows a road map of the Timaru district in the South Island. This road map can help you calculate the distance between towns.

- The red "pins" identify the main towns.
- The distances in kilometres between the towns are shown by red numbers.
- For example, the distance between Twizel and Lake Tekapo is 47 km.
- The scale of 1 cm to 5 km at the bottom of the map can help you work out the straight-line distance between two places.
- For example, the straight line distance between Omarama and Hakataramea, measured with the ruler shown in the diagram, is 10 cm which converts to 50 km.

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## C Acceleration -Time Graph

Figure 3 shows an acceleration versus time graph for a car journey made in four parts.

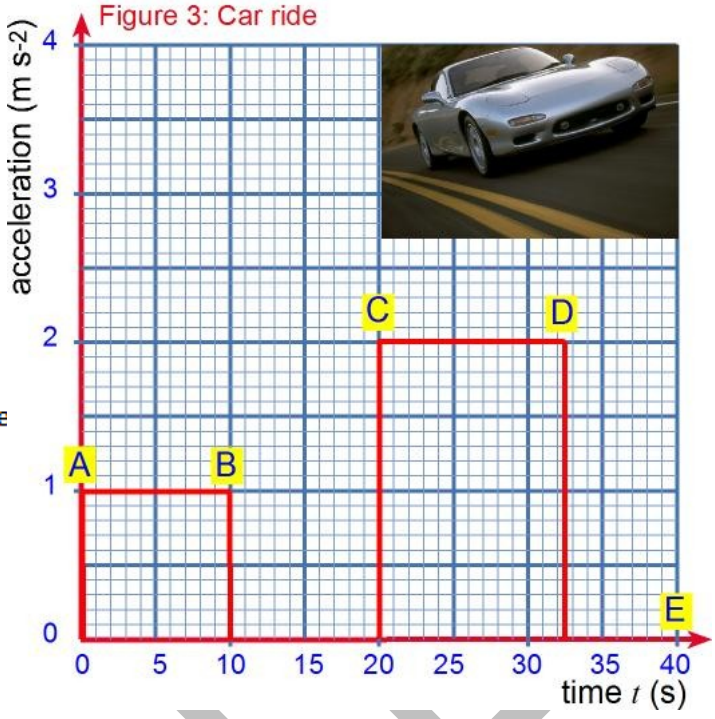
Section AB shows the car increasing its speed from zero at a uniform rate so that it has a constant acceleration of 1.0 m $s^{-2}$.

1. **The change in speed** *is equal to the area under the graph*.
2. For section AB,

   the change in speed = area unde
   $(1.0 - 0) = 10$ m $s^{-1}$ to 2 sf.

3. For section AB the car increases its speed from zero to 10 m $s^{-1}$.
4. For section BC, the acceleration of the car is zero, so it moves at a constant speed of 10 m $s^{-1}$.

Figure 3: Car ride




## Notes



**eLearning:** Students
- access Live-wire modules
- answer questions and get instant feedback (correct/incorrect)
- click for explanations to learn from their mistakes
- repeat modules to improve scores, knowledge and encounter more challenging questions
- record their attempts.

Teachers can view work books or results on the Learning Management Suite.

## COMPUTER WORK

Log on to Live-wire Learning and answer the questions.

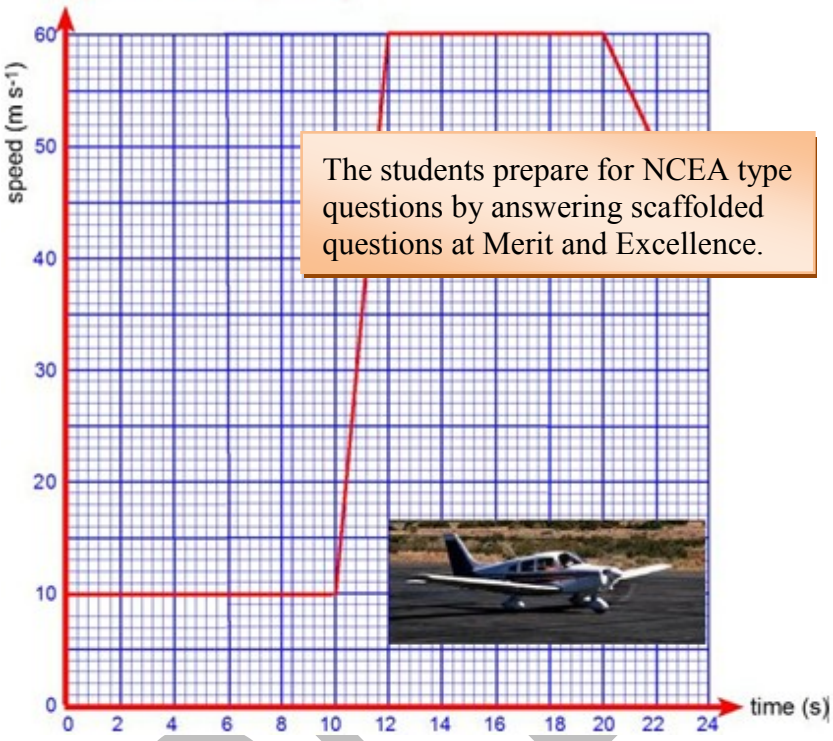
| MODULE | First Attempt /10 | Working at | Second Attempt /10 | Working at |
|---|---|---|---|---|
| Motion and Time – Achieved Only | | | | |
| Motion and Time | | | | |

**Merit Level Questions**

**Q. 1.** Figure 4 shows the speed versus time graph for an aircraft journey.

a) Calculate the acceleration of the aircraft at time 4 s.

Figure 4: Aircraft journey




The students prepare for NCEA type questions by answering scaffolded questions at Merit and Excellence.

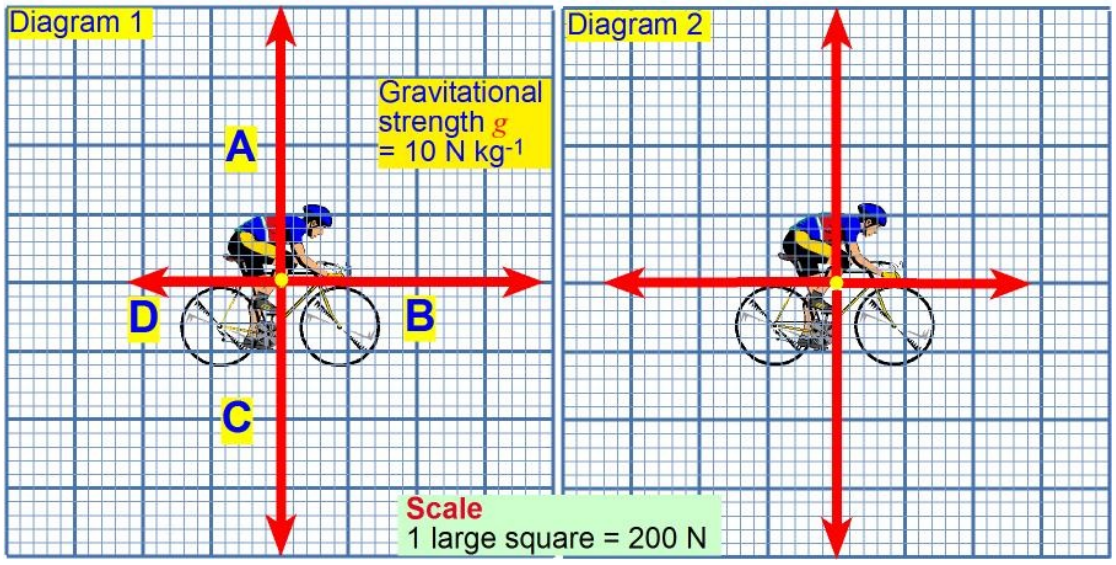
b) Calculate the acceleration of the aircraft at time 22 s.

c) Explain during which times the speed of the aircraft is increasing.

**Excellence Level Questions**

**Q. 2.** Figure 8 – Resource 3 in the learning notes shows Jason's cycle ride. The diagrams show two situations of the four forces acting on Jason and his bike while he is riding along a level road. The scale of the two diagrams is 1 large square representing a force of 200 N.

Figure 8: Free-Body Force Scale Diagrams for Jason's Cycle Ride




a) Discuss Diagram 1, by describing each of the forces labelled A to D.

Sample answers provided at the back of the book.

# QUESTIONS AND ANSWERS

**MOTION AND SPEED**

**Merit Level Answers**

**Q. 1.** Figure 6 shows the three sections of a motor-cyclist's journey.

a) What is the average speed of the motor-cyclist between points A and B, in km $hr^{-1}$, to the correct number of significant figures.

- 41.0 km $hr^{-1}$.
- The average speed of the motor-cyclist between points A and B is given by

$$v = \frac{\Delta d}{\Delta t} = \frac{1.65}{145/3600} = \frac{1.65 \times 3600}{145} = 40.965517 = 41.0 \text{ km hr}^{-1} \text{ to 3 sf.}$$

**Excellence Level Questions**

**Q. 2.** Figure 8 – Resource 3 in the learning notes shows Jason's cycle ride. The diagrams show two situations of the four forces acting on Jason and his bike while he is riding along a level road. The scale of the two diagrams is 1 large square representing a force of 200 N.

a) Discuss Diagram 1, by describing each of the forces labelled **A** to **D**.
   - Force **A** is the support force the road supplies to support Jason and his bike.
   - Force **B** is the thrust force exerted by Jason.
   - Force **C** is the weight of Jason and his bike.
   - Force **D** is the air resistance force acting on Jason and his bike.

b) Discuss Diagrams 1 and 2
   - The two free-body force diagrams show the actual forces acting on Jason and his bike.
   - The scale of the two diagrams has a small square representing 40 N.
   - Each of the free-body force diagrams may be resolved either vertically or horizontally.
   - Newton's First Law of Motion may be applied in a direction where the forces acting on Jason and his bike are balanced.

Newton's Second Law of Motion may be applied in a direction where the forces acting on Jason and his bike are unbalanced.



## Live-wire Learning – e-Livewire

Part of the log-in instructions so that students can activate their e-learning codes.

**1. To Access the Site**

Go to http://my.livewirelearning.co.nz

Then

Click on the **Create your profile** button (if you do not already have a log in.) and fill in the following:

- Name: use your first name and surname
- LoginID: use some abbreviation of your name
- Password: create an easily remembered password
- email: use your home or school email address so that if you forget your login details that can be emailed to you
- School: select your school from the drop down list.

Click on the **Make my new profile** button.

You are now on the **Choose a Subject** page

**2. To Register a Subject and Activate a Licence**

a. Click on the appropriate subject. E.g., **Science NCEA Level 1** ...

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# NCEA SCIENCE LEVEL 1

## AS 90944 - 1.5

## Demonstrate understanding of aspects of Acids and Bases

Revision Workbook

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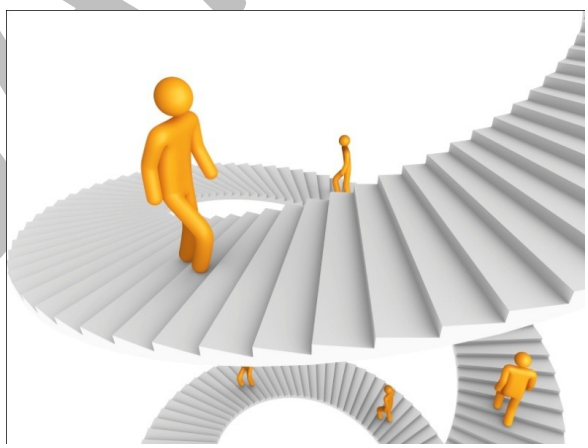
Interactive Web-based Learning



Murray Quartly and Emma Barker





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**Achievement Standard Science 1.5 (90944)**
**Demonstrate understanding of aspects of acids and bases. (External)**

**Learning Outcomes:** *By the end of this module you will be able to*
*1. State the difference between protons, neutrons and electrons.*
*2. Describe how these particles are arranged in a neutral atom.*
*3. Relate the number of protons, neutrons and electrons to the atomic number and mass number of a neutral atom.*

# 1. The Structure of the Atom

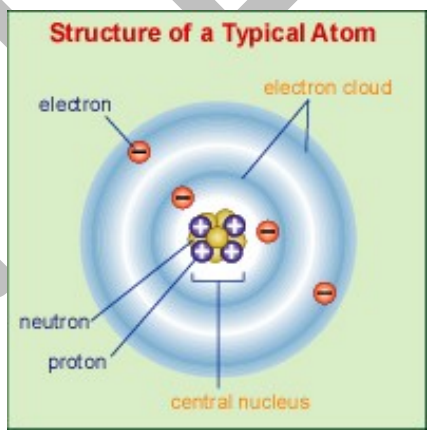
## Background

The atom is the smallest chemically indivisible particle of an element that can exist.
An element is a substance made up of identical atoms.

## Points to Note

### A Structure

**Figure 1**




1. An atom consists of a small dense nucleus surrounded by negatively charged sub atomic particles called electrons.

2. The nucleus is made up of two other subatomic particles: the proton and the neutron. The electrons are found surrounding the nucleus.

3. The area of negative charge around the nucleus is sometimes referred to as an electron cloud. The protons and neutrons are held in the nucleus by a strong nuclear force.

4. The negatively charged electrons do not repel each other as they are too far apart.

### B Charges and Sizes

1. The *proton* has a positive charge, a relative mass of 1 and is found in the nucleus.

2. The neutron has no charge, a relative mass of 1 and is found in the nucleus.

3. The electron has a negative charge, negligible mass and is located in the electron cloud surrounding the nucleus.

4. A neutral atom has equal numbers of protons and electrons.

**Figure 2** - The table below shows the three sub-atomic particles, their charges and relative mass.

| Subatomic Particle | Charge | Relative Mass | Location |
|---|---|---|---|
| Proton | positive | 1 | nucleus |
| Electron | negative | negligible | electron cloud |
| Neutron | neutral | 1 | nucleus |

## C Atomic number

The number of protons in the nucleus is unique to each element. It is called the atomic number.

## D Mass number

1. The sum of the neutrons and protons is called the mass number.

2. Mass number = number of protons + number of neutrons

3. The mass and atomic numbers of an element can be found on the periodic table. For example:

Helium has an atomic number of 2 and thus has 2 protons. Its mass number is 4, so it has 2 neutrons


## E Electrons

1. The number of electrons is always equal to the number of protons in an atom. This is why atoms are neutral.

| Element | Atomic number | Mass number | Protons | Neutrons | Electrons |
|---|---|---|---|---|---|
| Lithium | 3 | 7 | 3 | 4 | 3 |
| Carbon | 6 | 12 | 6 | 6 | 6 |
| Fluorine | 9 | 19 | 9 | 10 | 9 |
| Aluminium | 13 | 27 | 13 | 14 | 13 |
| Chlorine | 17 | 35 | 17 | 18 | 17 |

2. The number of neutrons in the nucleus of an atom can vary. Two atoms with the same atomic number can have a different number of neutrons.

## F Isotopes

An isotope is an element with same number of protons but a different number of neutrons. This means they have the same atomic number but different mass numbers. They are the same element therefore they have the same chemical properties. An isotope with more neutrons is in fact a heavier atom than an isotope with a smaller amount of neutrons.

For example:

Chlorine occurs naturally as $^{37}Cl$ (20 neutrons) and $^{35}Cl$ (18 neutrons). They both have the same chemical properties but $^{37}Cl$ is the heavier atom with two more neutrons.

You may have noticed that the atomic mass given for some elements on the Periodic Table is not a whole number. This is because it is the average atomic mass of all isotopes that exist for that element.



**COMPUTER WORK -** Log on to Live-wire Learning and answer the questions.

| MODULE | First Attempt /10 | Working at | Second Attempt /10 | Working at |
|---|---|---|---|---|
| Structure of the Atom – Achieved Only | | | | |
| Structure of the Atom | | | | |

**Merit Level Questions**

You will need to refer to the Periodic Table on page 8 to answer some of the questions below.

**Q.1.** $^{23}Na$ and $^{22}Na$ are neutral atoms. Explain what makes them neutral. Your explanation must include their atomic structure and electron number.

**Q.2.** Most periodic tables show the mass number of chlorine as 35.45. Explain how chemists came up with this number.

**Q.3.** Helium forms 2 isotopes. These isotopes are $^{3}He$ and $^{4}He$. What is the difference between these two isotopes?

**Excellence Level Questions**

**Q.1.** Discuss the differences and similarities between the two isotopes of helium mentioned above and comment on any difference in mass.

**Q.2.** Compare and contrast $^{24}Na$, $^{23}Na$ and $^{24}Mg$. You must include reference to each of the sub atomic particles and the differences in atomic mass.

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# NCEA SCIENCE LEVEL 1

## AS Science 1.9 (90948)

## Demonstrate understanding of biological ideas relating to genetic variation. (External)

Revision Workbook

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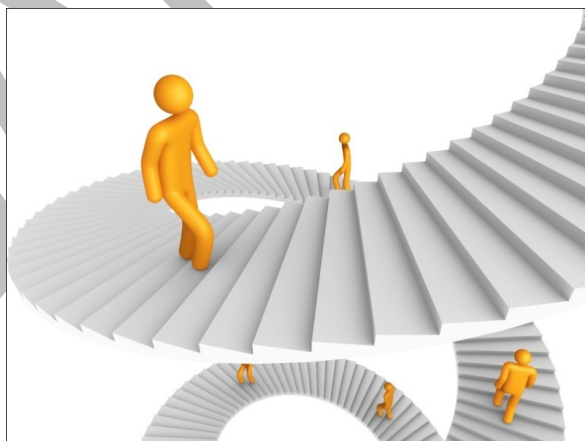
Interactive Web-based Learning



editor Cara Scott

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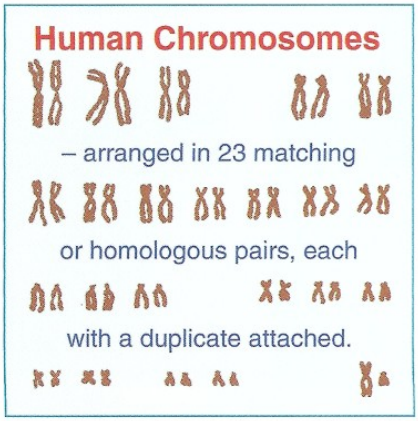
**Learning Outcomes:** *By the end of this module you will be able to*
*(1) describe what chromosomes, genes, alleles and DNA are*
*(2) explain the relationship between chromosomes, genes, alleles and DNA.*

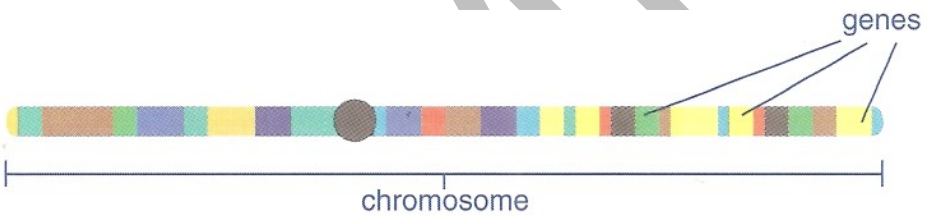
# Chromosomes, Genes, Alleles and DNA

## Points to Note

### A Chromosomes, genes, alleles and DNA



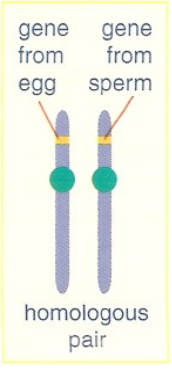

**1. Chromosomes** – are found in the nucleus of plant and animal cells.
a. Under a very powerful microscope they usually look like pieces of thread tangled together but during cell division they appear as short, separate threads.
b. Different types of living things have different numbers of chromosomes.
c. Humans have 23 homologous pairs of chromosomes (a total of 46).
d. The chromosomes in a homologous pair are similar in size and appearance and carry genes for the same characteristics.
e. One chromosome of each pair came from the person's father and one from the mother.
f. The chromosomes of an individual of a species are like an owner's manual. They carry all the genetic information a living thing needs to grow and develop.




**2. Genes** - Each chromosome is made up of a number of parts called genes**.**
a. Each gene carries coded instructions on how to make a particular protein. These proteins may be structural, for example, used to make hair or the pigment that gives your eye colour or they may be involved in cell reactions to provide energy as enzymes do.
b. The total collection of genes in an individual is called the genome**.**

**3. Alleles** - For each characteristic there can be different instructions.

a. These different forms of a gene are called alleles. (For example, there is an allele for curly hair trait and another allele for straight hair trait. They are both instructions related to how hair looks so they are alleles of the same gene.)




b. These genes for each characteristic are located in the same place on each of the chromosomes that make up a homologous pair. Therefore each individual has 2 alleles for almost all genes.

**Merit Level Questions**

Q.1. Explain how the information contained in DNA gives a person their individual characteristics?

Q.2. Explain what a genome is and why it is important.

A genome is

Q.3. Genes are expressed through proteins that determine the appearance or trait of a characteristic. Explain what this statement means.

Q.4. If the base code down one half of the DNA ladder is represented by the letters TCGAACGTTCAG, explain what the sequence will be in the other side and why.

**Excellence Level Questions**

Q.1. Discuss fully the relationship between chromosomes, genes and alleles.