OXFORD CAMBRIDGE AND RSA EXAMINATIONS

GENERAL CERTIFICATE OF SECONDARY EDUCATION

A218/01/RB

TWENTY FIRST CENTURY SCIENCE

ADDITIONAL SCIENCE A

Unit 4: Ideas in Context (Foundation Tier)

RESOURCE BOOKLET

JUNE 2010

To be opened on receipt

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

READ INSTRUCTIONS OVERLEAF

DC (CW/SW) MEP60310 29677/1

INSTRUCTIONS TO CANDIDATES

- **This booklet contains three articles.**

- **Take these articles away and read them through carefully.**

- **Spend some time looking up any technical terms or phrases you do not understand.**

- **For the examination on WEDNESDAY 9 JUNE 2010 you will be given a fresh copy of these articles, together with a question paper.**

- **You will NOT be able to take your original copy into the examination with you.**

THE ANALOGUE TO DIGITAL SWITCHOVER

TV services in the UK are going completely digital. This started in 2008 and finishes in 2012. It is happening TV region by TV region. This process is called digital switchover.

The UK's old television broadcast signal (known as "analogue") is being switched off and replaced with a "digital" signal. Any TV set that's not converted to digital when the switchover takes place will no longer receive TV programmes.

ANALOGUE VERSUS DIGITAL

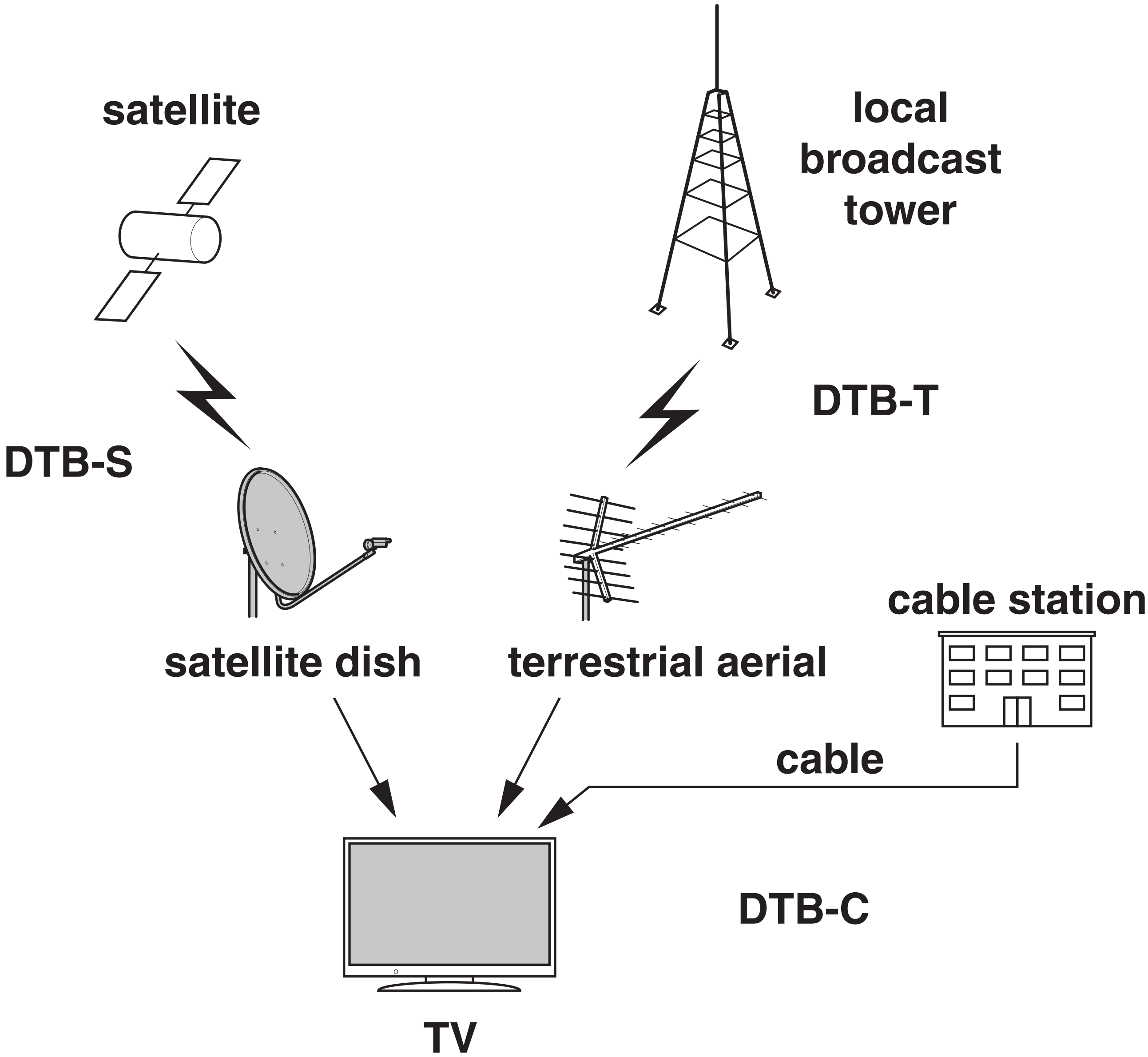
The old analogue signals vary continuously over many values but the new digital signals only use two values (off and on).

With analogue TV, the picture and sound of the TV are modulated onto a radio wave that is then transmitted to the aerial receiver. In the TV, the signal is amplified and demodulated to give the picture and sound again.

With digital TV, sound and pictures are converted into 'bits' of information and this pattern of '0's and '1's is sent through a terrestrial aerial, satellite, or cable. This digital signal is then turned back into pictures and sound by a digital box or a digital TV set, which decodes the pattern.

One of the reasons for the switchover is that a digital signal can give better quality than analogue. It gives better quality pictures and sound, with much less interference or 'noise'. TV pictures are clearer, with no 'ghosting', and sound has no crackling or hissing.

HOW CAN YOU GET DIGITAL TV?



You can receive digital TV broadcast signals from satellites (DTB-S), local broadcast towers (DTB-T) or via cable (DTB-C).

The different transmission methods use different parts of the electromagnetic spectrum to transmit the TV signals. For example, terrestrial aerials use radio waves, but satellites don't use radio waves because the ionosphere in the Earth's atmosphere can prevent the transmission. Cable uses fibre optics to send the TV signals. Engineers can use the wave equation to work out the speeds, frequencies and wavelengths of the transmissions.

A FACT OF LIFE – IVF AND ITS APPLICATION

On 25th July 1978, Louise Joy Brown, the world's first successful 'test-tube' baby was born in the United Kingdom. The procedure that made her conception possible was seen as a triumph in medicine and is called in vitro fertilisation (IVF).

Egg and sperm cells are produced by meiosis. These cells are known as gametes. Under natural conditions, the process of fertilisation takes place when the egg and sperm cells meet inside the body of the woman. During this process, the gametes fuse to form a zygote. The zygote divides by mitosis to form an embryo. The embryo becomes attached to the wall of the woman's womb and she is pregnant.

For some people, this process is not possible. The man or woman, or both, may be infertile. Such people may choose to use IVF to enable the woman to become pregnant. In the process of IVF, an egg cell is fertilised by a sperm cell outside of the woman's body. This is carried out in a small Petri dish but the babies have since been called 'test-tube' babies.

THE IVF PROCESS

Nowadays, IVF is a major treatment of infertility. The process involves six stages:

STAGES

1 Fertility drugs stimulate the woman's ovaries to develop several mature egg cells.
2 Egg cells are removed from the woman's ovaries.
3 Sperm cells and egg cells are incubated together in a Petri dish.
4 A sperm cell fertilises the egg cell.
5 The fertilised egg (zygote) divides to form an embryo.
6 The embryo is placed into the woman's womb so that she may become pregnant.

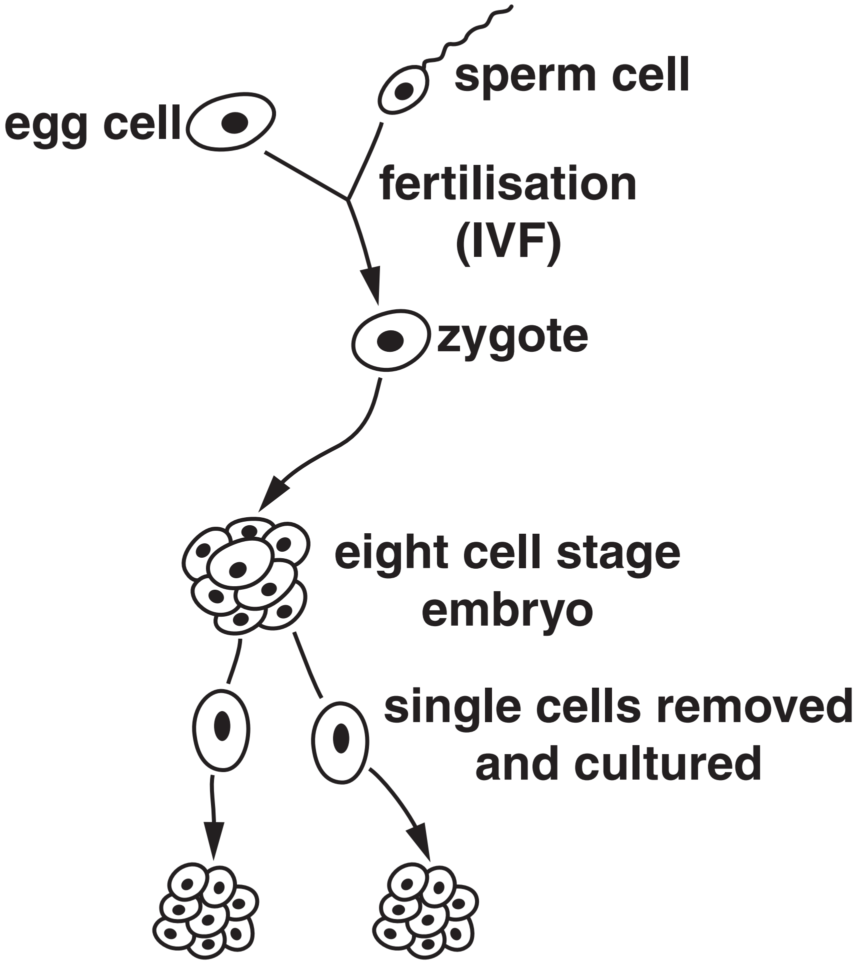
NUMBERS OF IVF BABIES

Many thousands of IVF babies have been born worldwide since the technique was first used successfully in 1978. According to the Human Fertilisation and Embryology Authority, one in every 80 babies born in the United Kingdom is now conceived using IVF.

APPLICATIONS OF THE IVF PROCESS

IVF can be used to produce clones. Scientists have cloned some domestic animals including sheep, pigs, cows and horses.

It is now possible to use a single embryo, produced by IVF, to make identical clones of these domestic animals. Cells are taken from the embryo and cultured.



identical embryos (clones) transferred
to the womb of a female animal

Cells must be collected before the embryo has divided into more than eight cells. If the cells are collected after this stage they have become too specialised and form different types of tissue.

In this technique, each cell removed from the original embryo is cultured to form a new embryo. The new embryo is then transferred to the womb of a female animal, where it grows and develops.

The cells within each cloned embryo specialise to form different types of cells for new tissues and organs. All the cells in an embryo contain the same genes. This means that every cell has the same genetic code in the nucleus. Each gene is made up of a combination of four different types of bases.

Each gene codes for the production of a specific protein in the cell cytoplasm. After the cells have specialised, the cells produce only the proteins they need, resulting in different tissue types such as nerve or muscle tissue.

A second application of IVF involves using stem cells from IVF embryos to form a range of tissue types for treating patients. For example, tissues from IVF embryos could be used to replace damaged brain cells in people with Alzheimer's disease.

MAKING USEFUL SALTS

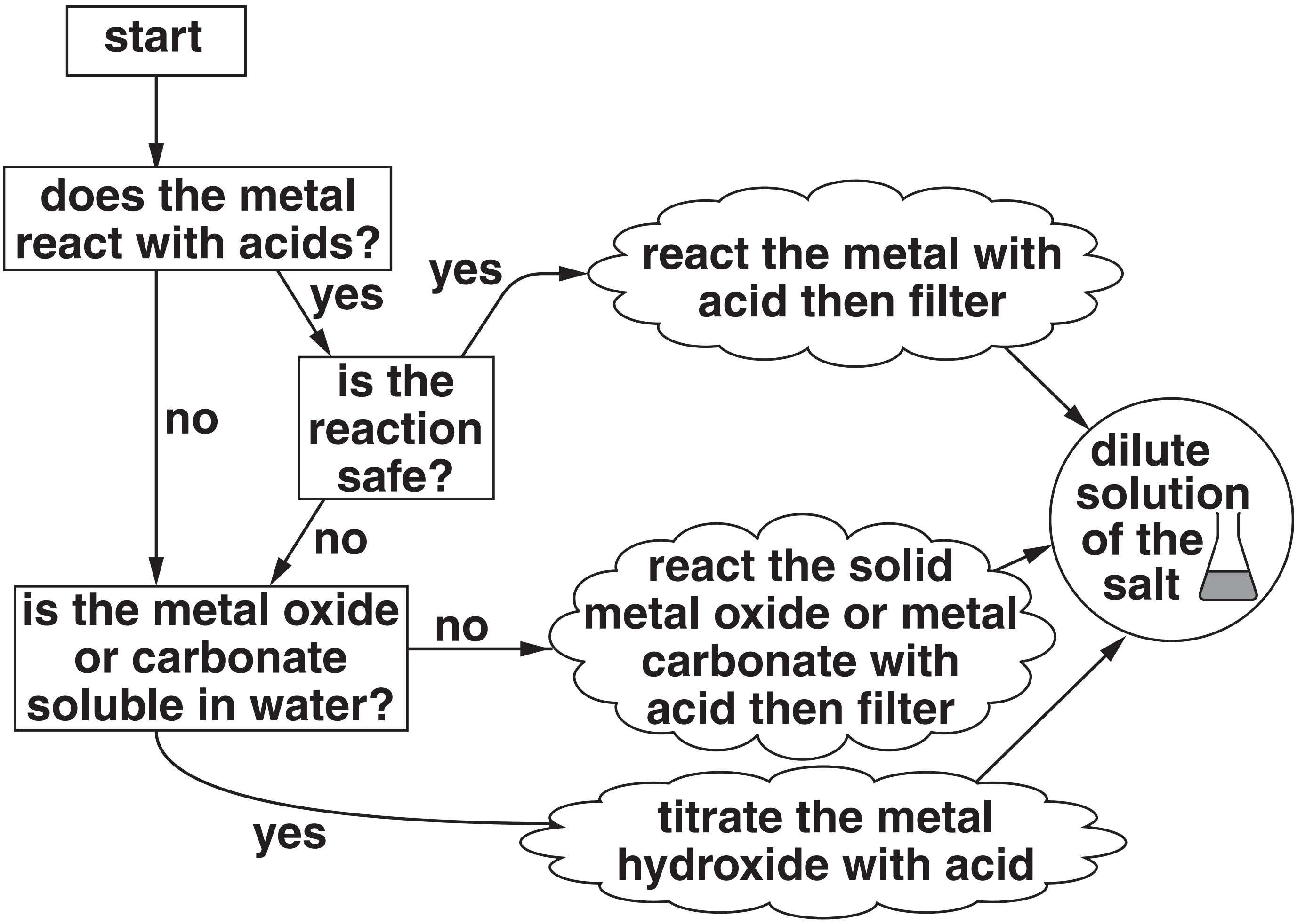
Salts are made on an industrial scale for a wide range of uses. The table shows information about some salts.

NAME OF SALT	USES	PARENT ACID
copper sulfate	fungicide	sulfuric acid
magnesium sulfate	medicines	sulfuric acid
sodium chloride	food additive	hydrochloric acid
sodium nitrate	fertilisers	nitric acid
calcium phosphate	washing powders	phosphoric acid

The 'parent acid' of a salt is the acid that is needed to make the salt, for example calcium phosphate is made using phosphoric acid. Common acids used in laboratories are nitric acid, hydrochloric acid and sulfuric acid.

MAKING SALTS

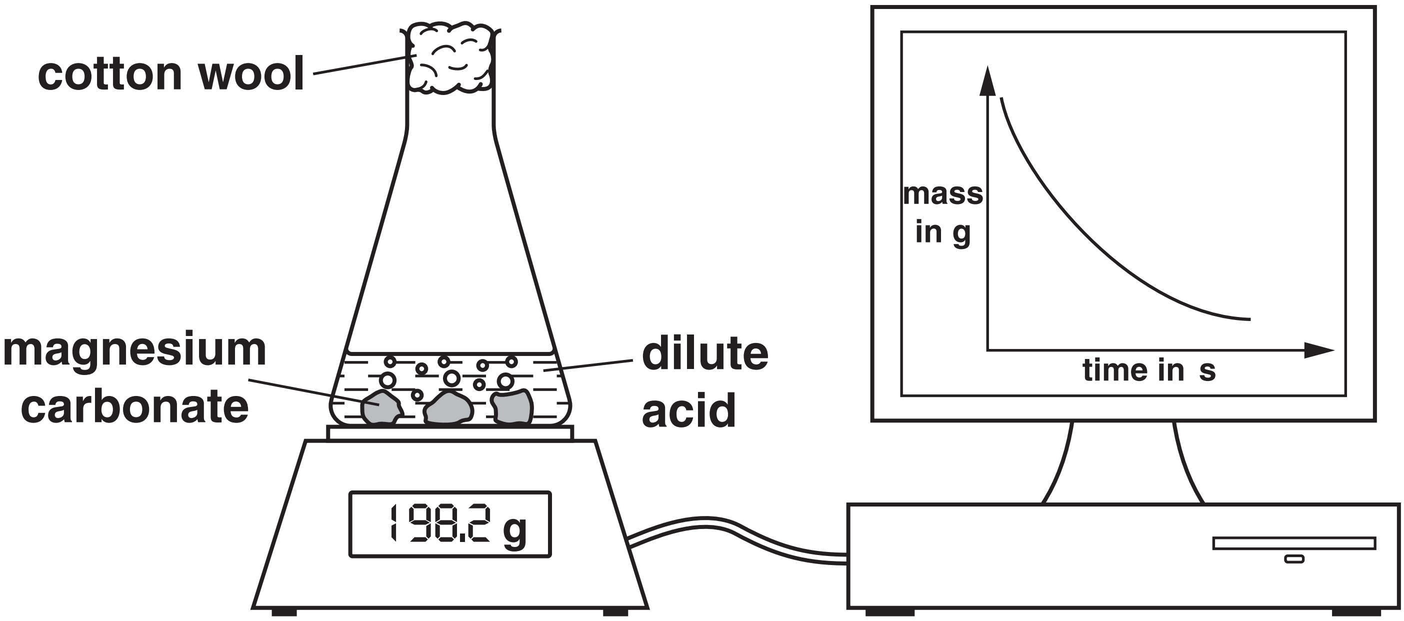
Chemists work in the chemical industry to find the best method to make salts. The chemists make salts on a small scale in the laboratory before thinking of ways to scale up the experiment so that it works on a factory scale. There are different starting chemicals that can be reacted with the parent acid to make the salt. The pure metal can sometimes be used. The metal cannot be used if it is too reactive. Instead, the chemists use the metal oxide, metal carbonate or metal hydroxide. The flow chart shows how to choose the best method for making a dilute solution of a particular salt.



FOLLOWING THE REACTION

Chemists are interested in making salts as quickly as possible and also in getting the best yield possible. A fast process with a high yield will probably be the most profitable for the company. To find out about the rate of reaction and the yield, chemists use a range of methods of following the reaction.

For example, if a carbonate is being used to make the salt, the mass of the flask and its contents can be measured during the reaction. A data logger can collect the information and show the results on a graph. The results can be used to follow the rate of reaction during the experiment.



Another method of following the reaction can be used if a titration is being carried out. The pH of the reaction mixture can be measured so that the chemists can see when the solution is neutral.

YIELD

At the end of the experiment, the crystals that are made can be dried in an oven or a desiccator and then weighed. The mass of the crystals can then be used to work out the percentage yield. Chemists work to adapt their experiments to get the highest yield possible.