Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GENERAL CERTIFICATE OF SECONDARY EDUCATION

A218/02

TWENTY FIRST CENTURY SCIENCE

ADDITIONAL SCIENCE A

UNIT 4
Ideas in Context (Higher Tier)

WEDNESDAY 9 JUNE 2010: Afternoon
DURATION: 45 minutes

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

Candidates answer on the Question Paper
A calculator may be used for this paper

OCR SUPPLIED MATERIALS:

Insert (inserted)

OTHER MATERIALS REQUIRED:

Pencil
Ruler (cm/mm)

READ INSTRUCTIONS OVERLEAF

DC (DS/DJ) MEP60415 30536/1

INSTRUCTIONS TO CANDIDATES

- **Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes on the first page.**
- **Use black ink. Pencil may be used for graphs and diagrams only.**
- **Read each question carefully and make sure that you know what you have to do before starting your answer.**
- **Answer ALL the questions.**
- **Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your Candidate Number, Centre Number and question number(s).**

INFORMATION FOR CANDIDATES

- **The number of marks is given in brackets [ ] at the end of each question or part question.**
- **The total number of marks for this paper is 40.**
- **A list of physics equations is printed on page three.**
- **The Periodic Table is printed on the back page.**
-  **Where you see this icon you will be awarded a mark for the quality of written communication in your answer.**

EQUATIONS

USEFUL RELATIONSHIPS

EXPLAINING MOTION

$$\text{speed} = \frac{\text{distance travelled}}{\text{time taken}}$$

$$\text{momentum} = \text{mass} \times \text{velocity}$$

$$\text{change of momentum} = \text{resultant force} \times \text{time for which it acts}$$

$$\text{work done by a force} = \text{force} \times \text{distance moved by the force}$$

$$\text{change in energy} = \text{work done}$$

$$\text{change in GPE} = \text{weight} \times \text{vertical height difference}$$

$$\text{kinetic energy} = \frac{1}{2} \times \text{mass} \times [\text{velocity}]^2$$

ELECTRIC CIRCUITS

$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

$$\frac{\text{voltage across primary coil}}{\text{voltage across secondary coil}} = \frac{\text{number of turns in primary coil}}{\text{number of turns in secondary coil}}$$

$$\text{energy transferred} = \text{power} \times \text{time}$$

$$\text{power} = \text{potential difference} \times \text{current}$$

$$\text{efficiency} = \frac{\text{energy usefully transferred}}{\text{total energy supplied}} \times 100\%$$

THE WAVE MODEL OF RADIATION

$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

Answer ALL the questions.

THIS QUESTION IS BASED ON THE ARTICLE 'THE ANALOGUE TO DIGITAL SWITCHOVER'.

1 (a) (i) Radio waves are a good way of transmitting terrestrial TV signals THROUGH THE ATMOSPHERE.

Explain why.

_____

_____ **[1]**

(ii) Radio waves are NOT used to send TV signals from satellites.

What type of electromagnetic wave is used to send signals from satellites?

Suggest a reason why this type of radiation is used instead of radio waves.

type of electromagnetic wave _____

reason _____

_____ **[2]**

(iii) The receiving dish for a satellite TV signal only works if it is made of metal.

Explain why it is made of metal.

_____

_____ **[1]**

(b) Digital TV signals can be received with higher quality than analogue signals.

Explain why.

You must include diagrams in your explanation.

_____

_____

_____

_____

_____ **[4]**

(c) An advantage of digital signals is that 'ghosting' can be removed by processing the digital signal.

Only one signal is transmitted.

Ghosting is when a receiver picks up the same signal twice.

There is a small time difference between the two signals arriving.

Suggest how a receiver picks up two copies of the signal and why the second signal is weaker than the first.

_____

_____

_____ **[2]**

(d) All electromagnetic waves travel at the same speed, 300 000 000 m / s.

One frequency used by satellites is 3 gigahertz (3 000 000 000 Hz).

Calculate the wavelength of the wave.

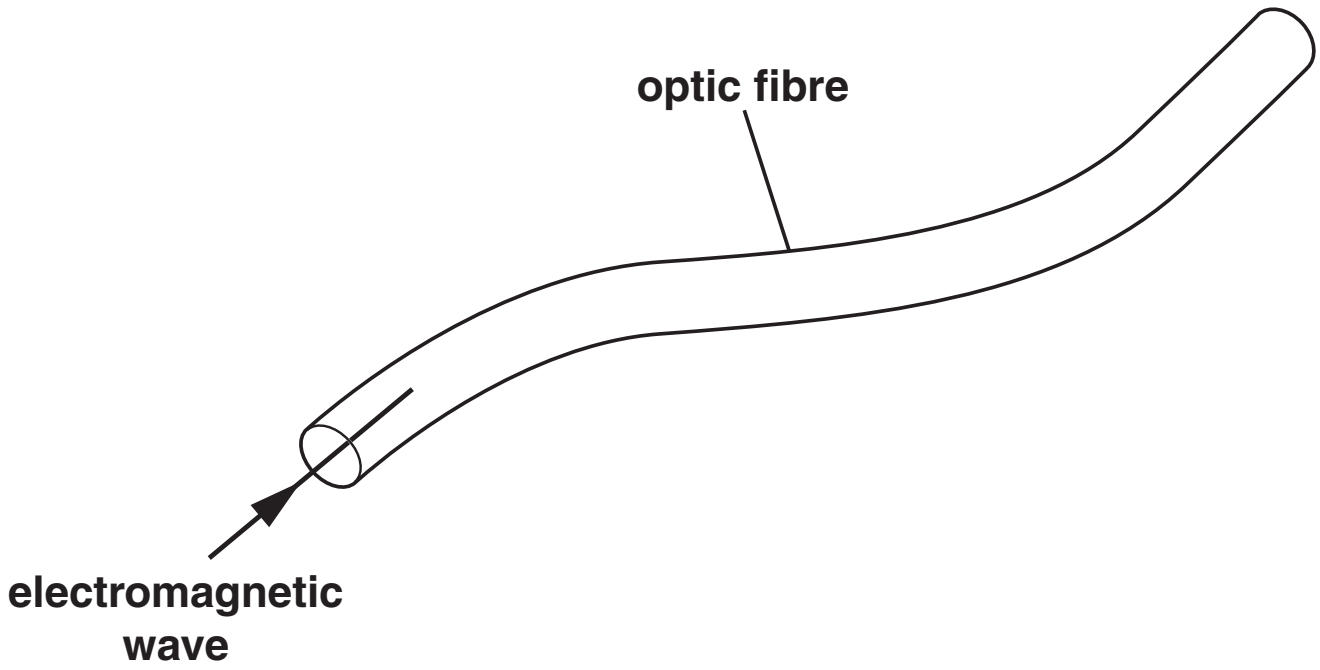
You must show your working.

wavelength = _____ m [2]

(e) Cable TV often uses fibre optic cables.

The electromagnetic waves are kept in the fibre optic cable by total internal reflection.

Complete the diagram to show the path of the electromagnetic wave through the optic fibre.



[1]

[Total: 13]

THIS QUESTION IS BASED ON THE ARTICLE 'A FACT OF LIFE – IVF AND ITS APPLICATION'.

2 (a) (i) Look at the information in the article about the IVF process.

The process involves six stages.

In the table opposite, put a tick (✓) in ONE BOX IN EACH ROW to show whether each stage involves ONLY MITOSIS, ONLY MEIOSIS or NEITHER MITOSIS NOR MEIOSIS.

[2]

(ii) Give one SIMILARITY and one DIFFERENCE between the way a zygote is formed in IVF and 'normal' fertilisation.

similarity _____

difference _____ **[2]**

(b) 668 000 live babies were born in the United Kingdom in 2006.

Using the information in the article, calculate the number of IVF babies born in the UK in 2006.

Show your working.

answer _____ **[2]**

STAGE		ONLY MITOSIS	ONLY MEIOSIS	NEITHER MITOSIS NOR MEIOSIS
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.			

(c) Animal embryos produced by IVF can be used to produce clones.

(i) What are clones?

_____

_____ **[2]**

(ii) Clones are produced from embryo cells that are removed at the eight cell development stage.

These clone cells then divide and specialise to form different types of tissue.

Explain how clone cells can produce different proteins to form different types of tissue.

Your answer should include

- **the difference between specialised and unspecialised cells**
- **what happens to the genes in the cells when the cells become specialised.**

_____

_____

_____

_____ **[2]**

(iii) Explain how different genes control the production of different proteins in cells.

_____

_____

_____

_____ **[3]**

[Total: 13]

THIS QUESTION IS BASED ON THE ARTICLE 'MAKING USEFUL SALTS'.

3 Ben works as a chemist for a company that makes salts.

(a) Ben wants to make some copper sulfate crystals.

Copper is an unreactive metal.

Copper carbonate and copper oxide do not dissolve in water.

Ben has some dilute sulfuric acid.

Describe how Ben could make some copper sulfate crystals.

Your answer should include

- **the name of the chemical you would add to the sulfuric acid**
- **a list of instructions to show the main steps in the experiment**
- **how you would get clean, dry crystals after the reaction.**

One mark is for correct spelling, punctuation and grammar.

_____

_____

_____

_____

_____

_____

_____ **[4+1]**

(b) Magnesium sulfate can be made by reacting magnesium with sulfuric acid.

Complete the equations for the reaction.

magnesium + sulfuric acid → magnesium sulfate + ☐

Mg + H_2SO_4 → ☐ **+** ☐

[2]

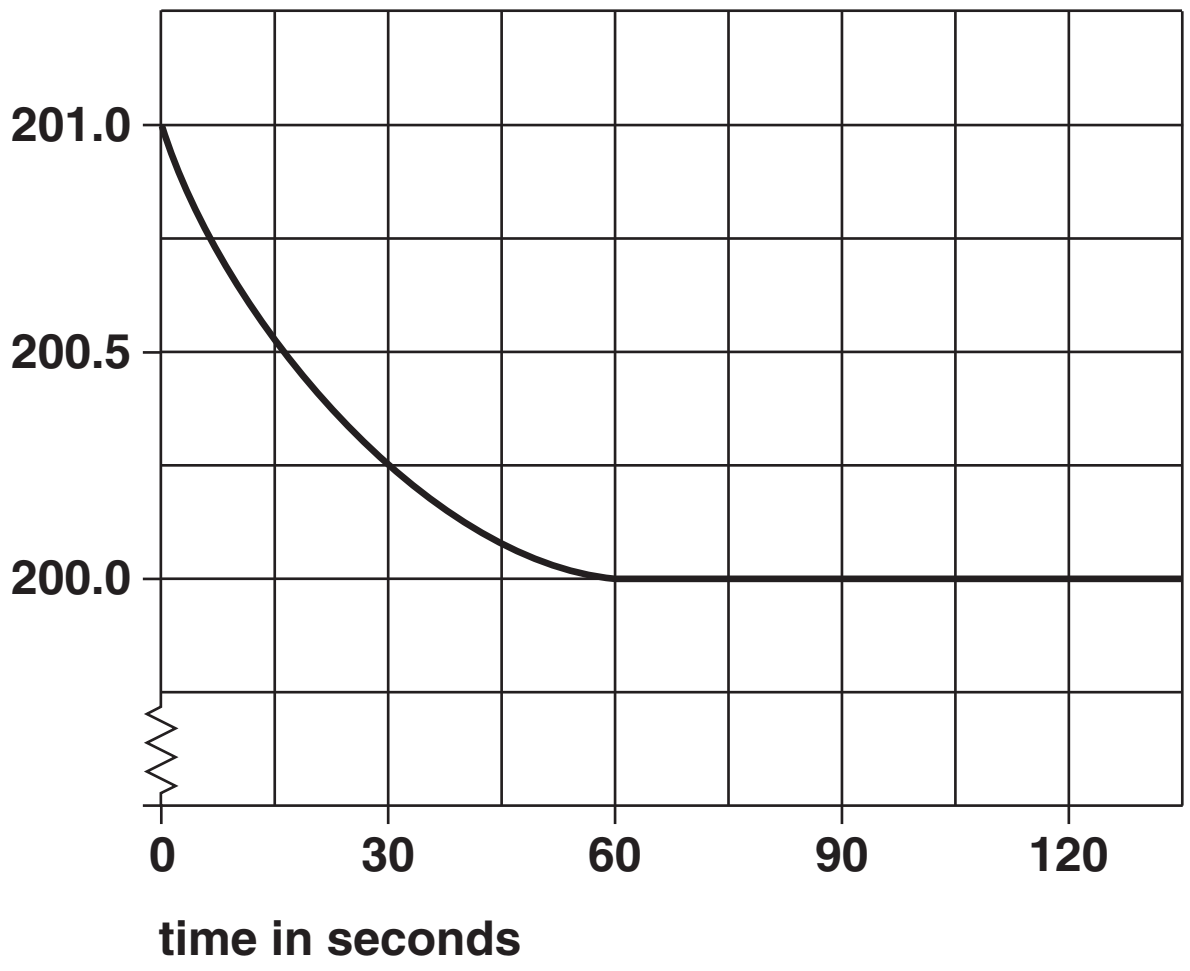
(c) Ben makes some magnesium chloride by reacting solid magnesium carbonate with a dilute acid.

He adds the magnesium carbonate to the dilute acid in a flask.

He uses a data logger to record the mass of the flask and its contents.

Some solid magnesium carbonate is left at the end of the experiment.

The graph shows how the mass changes during the reaction.



(i) Why does the <u>MASS</u> decrease during the experiment?

_____

_____ **[1]**

(ii) Describe and explain changes in the rate of reaction shown by the graph.

Your answer should include

- **how the <u>RATE</u> changes**
- **an <u>EXPLANATION</u> for the changes.**

_____

_____

_____

_____ **[3]**

(d) Ben makes some sodium chloride.

He reacts sodium hydroxide solution with hydrochloric acid solution using a titration.

Ben works out his theoretical yield of sodium chloride.

He collects his crystals in a weighing bottle and weighs them.

Here are his results.

THEORETICAL YIELD:	**2.5 g**
EXPERIMENT RESULTS:	
mass of empty weighing bottle	**4.8 g**
mass of weighing bottle and crystals	**6.3 g**

(i) Work out Ben's percentage yield.

answer _____ % [1]

(ii) Ben's friend, Sam, also made some sodium chloride crystals in the same way.

He did not dry his crystals properly before he weighed them.

Explain <u>HOW</u> and <u>WHY</u> weighing wet crystals would make Sam's calculation of percentage yield wrong.

_____

_____ **[2]**

[Total: 14]

<u>END OF QUESTION PAPER</u>

BLANK PAGE

The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

**** The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.***

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.