

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE

A218/02

ADDITIONAL SCIENCE A

Unit 4: Ideas in Context (Higher Tier)

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

OCR Supplied Materials:

- Insert (inserted)

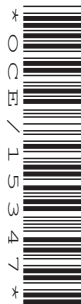
Other Materials Required:

- Pencil
- Ruler (cm/mm)

Wednesday 9 June 2010

Afternoon

Duration: 45 minutes



Candidate Forename		Candidate Surname	
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Centre Number						Candidate Number				
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INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- 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.
- Do **not** write in the bar codes.
- 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 two.
- 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.
- This document consists of **12** pages. Any blank pages are indicated.

TWENTY FIRST CENTURY SCIENCE 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]

4

- (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]

5

- (d) All electromagnetic waves travel at the same speed, $300\,000\,000\text{ m/s}$.

One frequency used by satellites is 3 gigahertz ($3\,000\,000\,000\text{ Hz}$).

Calculate the wavelength of the wave.

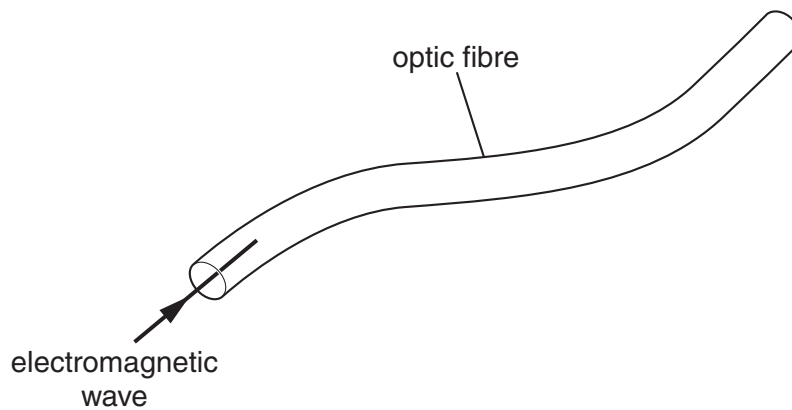
You must show your working.

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.

Put a tick (✓) in **one box in each row** to show whether each stage involves **only mitosis**, **only meiosis** or **neither mitosis nor meiosis**.

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.			

[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]

(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]

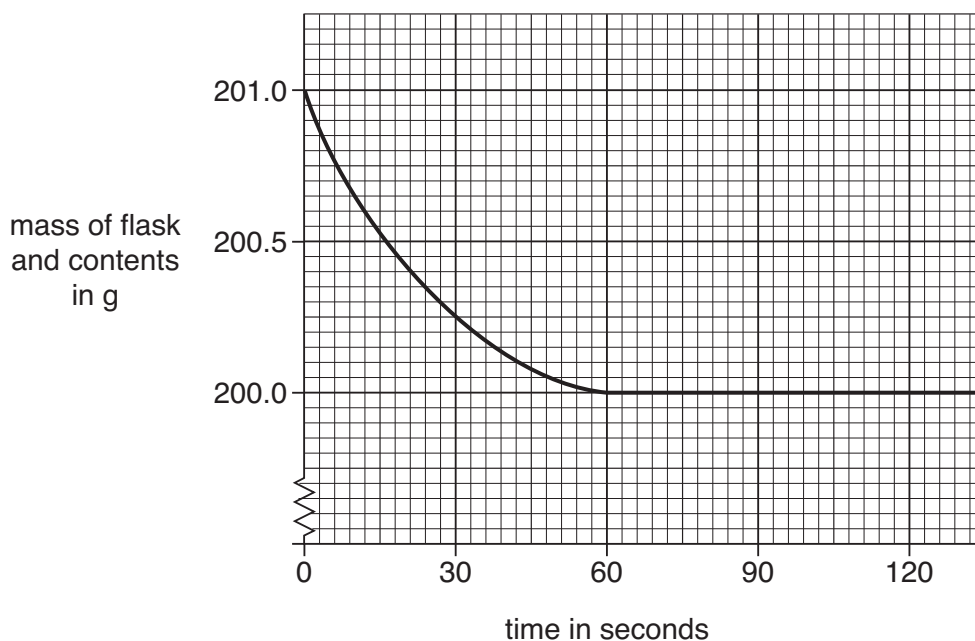
- (c) Ben makes some magnesium chloride by reacting solid magnesium carbonate with a dilute acid.

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 **mass** 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 **rate** changes
- an **explanation** for the changes.

.....
.....
.....
..... [3]

10

(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 **how** and **why** weighing wet crystals would make Sam's calculation of percentage yield wrong.

.....

..... [2]

[Total: 14]

END OF QUESTION PAPER

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The Periodic Table of the Elements

1	2	Key					3	4	5	6	7	0					
		relative atomic mass atomic symbol name atomic (proton) number															
7 Li lithium 3	9 Be beryllium 4	23 Na sodium 11	24 Mg magnesium 12									11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10
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.