OCR
RECOGNISING ACHIEVEMENT

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A218/02

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE

ADDITIONAL SCIENCE A

Unit 4: Ideas in Context (Higher Tier)

FRIDAY 23 MAY 2008

Afternoon
Time: 45 minutes

Candidates answer on the question paper.
Additional materials (enclosed):
Insert

Calculators may be used.
Additional materials: Pencil
Ruler (cm/mm)

CUP/T48676

Candidate Forename		Candidate Surname	
Centre Number		Candidate Number	

INSTRUCTIONS TO CANDIDATES

- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use blue or 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.

INFORMATION FOR CANDIDATES

- The number of marks for each question 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.

FOR EXAMINER'S USE		
Qu.	**Max.**	**Mark**
1	12	
2	14	
3	14	
TOTAL	40	

This document consists of **11** printed pages, **1** blank page and an insert.

EQUATIONS

Useful Relationships

Explaining Motion

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

momentum = mass × velocity

change of momentum = resultant force × time for which it acts

work done by a force = force × distance moved by the force

change in energy = work done

change in GPE = weight × vertical height difference

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

Electric Circuits

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

$$\frac{V_p}{V_s} = \frac{N_p}{N_s}$$

energy transferred = power × time

power = potential difference × current

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

The Wave Model of Radiation

wave speed = frequency × wavelength

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PLEASE DO NOT WRITE ON THIS PAGE

Question 1 starts on page 4

Answer **all** the questions.

This question is based on the article 'Tufa towers at Mono Lake, California'.

1 **(a)** The tufa rock is made from calcium carbonate.

The calcium carbonate forms when calcium ions in the hot springs react with carbonate ions in the lake water.

(i) Complete the equation for the reaction by filling in the missing **formula** and **state symbols**.

Ca^{2+}(……) + CO_3^{2-}(……) → …… (……) [2]

(ii) Tufa towers only form around the hot springs.

They do not form at other places in the lake.

Explain why.

.....

..... [2]

(b) Calcium carbonate is an ionic solid.

The table shows some information about ions dissolved in lake water and ions in solid calcium carbonate.

Complete the table.

	ions dissolved in the lake water	**ions in solid calcium carbonate**
movement of ions	move freely around other ions and water molecules	
arrangement of ions	random arrangement	

[2]

(c) Joe visits the lake and carries out some experiments.

He finds that the water is a good electrical conductor.

Explain how water that contains dissolved ionic compounds conducts electricity.

.....

..... [2]

(d) The salt crystals at the edge of the lake contain sodium chloride and magnesium chloride.

name	**formula**
sodium chloride	$NaCl$
magnesium chloride	$MgCl_2$

Chloride ions have a charge of –1.

Explain why the formulae of these two salts contain different numbers of chloride ions.

.....

..... [1]

(e) The article gives a recipe for making fake lake water.

(i) Give **one** way the fake lake water is similar to the real thing.

..... [1]

(ii) Suggest **two** ways that the fake lake water is different from the real thing.

.....

..... [2]

[Total: 12]

This question is based on the article 'Bendy lampposts save lives'.

2 **(a)** The article says that the momentum of the car can be reduced by about 30%.

(i) What **two** measurements do scientists need to make to calculate momentum?

How do you use the measurements to calculate momentum?

One mark is for a clear, ordered answer.

.....

.....

.....

..... [3+1]

(ii) Any collision involves two forces.

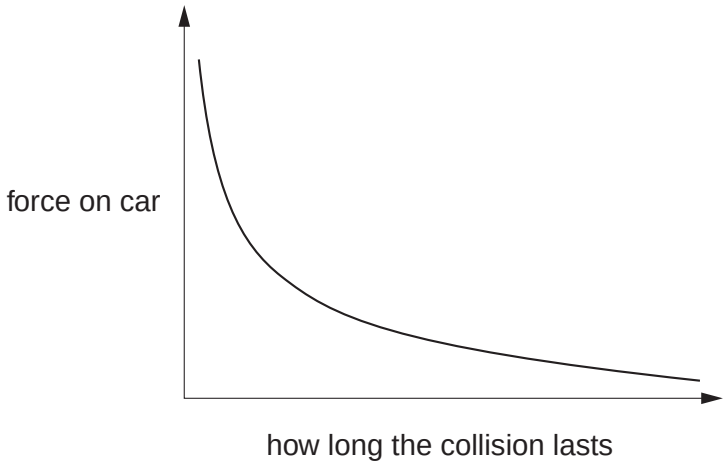
One force changes the momentum of the car.

What does the other force do?

.....

..... [1]

(b) The graph shows how the force on the car changes with how long the collision lasts.



Explain how a bendy lamppost reduces injuries in a collision.

Use the graph to help you.

.....

.....

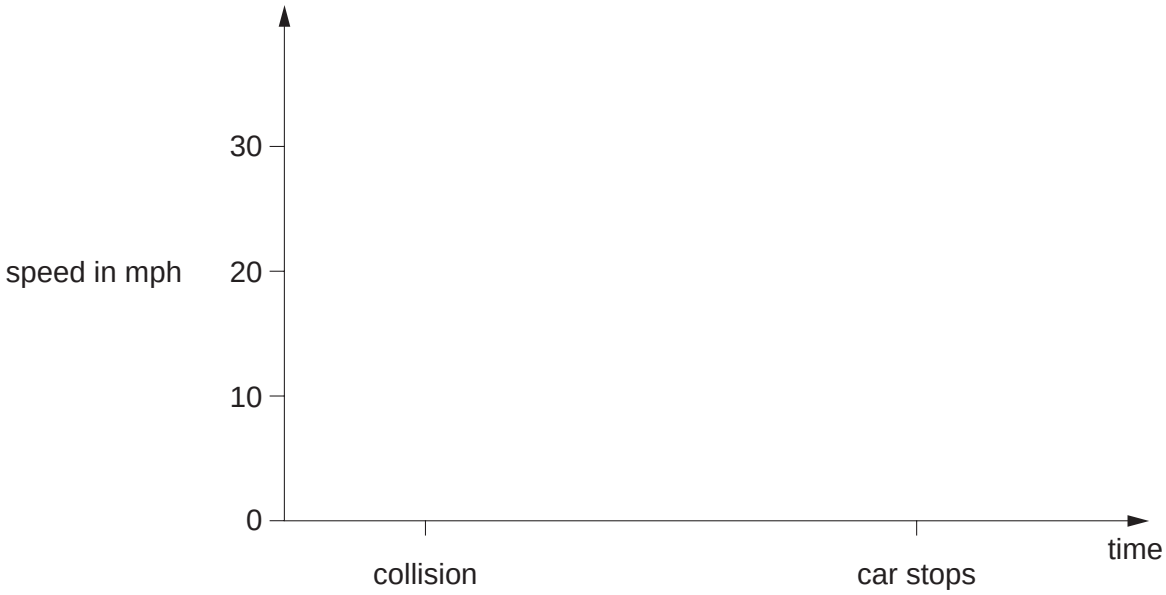
.....

..... [2]

(c) The speed of the car changes during and after a collision with a lamppost which breaks during the collision.

The car travels at 30 mph.
It then hits the lamppost.
The lamppost reduces the momentum of the car by one third.
After hitting the lamppost, the driver stops the car.

Draw a line on the graph to show how the car's speed changes with time.



[3]

(d) If the car hits the newest type of lamppost, it can slide up the lamppost during the crash.

(i) When the car has slid up the lamppost, the gain in gravitational potential energy is 22 500 Joules.

Calculate what the speed of the car had been if all its kinetic energy was transferred to gravitational potential energy.

Mass of car = 1500 kg

You must show your working.

speed = ... m/s [3]

(ii) The speed you calculated is less than the actual speed.

Explain why.

.....

..... [1]

[Total: 14]

This question is based on the article 'Cot deaths linked to brain abnormality'.

3 **(a)** The pictures show scans through part of the brain called the cerebral cortex.

Describe **two** functions of the cerebral cortex.

.....

.....

..... [2]

(b) Kinney and Paterson thought that a lack of receptors for serotonin was responsible for SIDS.

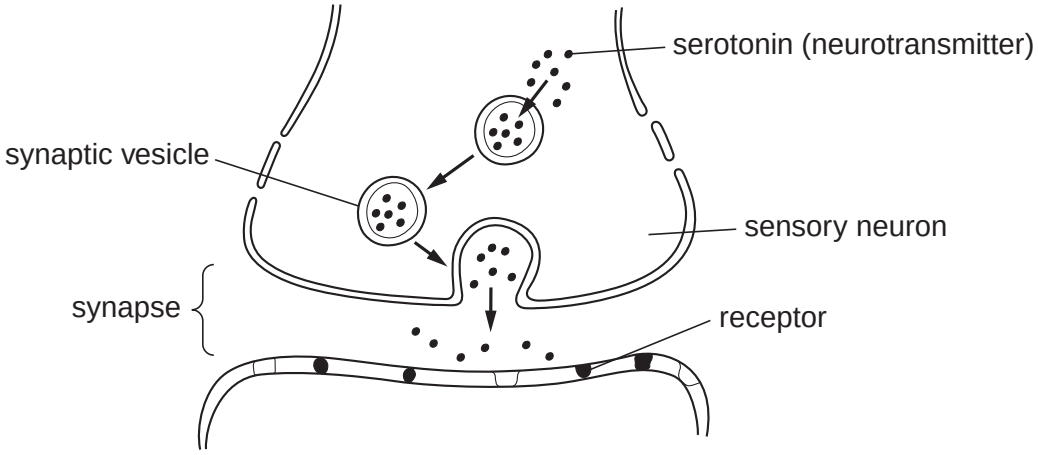
Look at the article about cot deaths and suggest **two** reasons why the evidence is not conclusive.

.....

.....

..... [2]

(c) The diagram shows how serotonin is produced by neurons in the cerebral cortex of a normal baby's brain.



(i) Describe how the diagram might be different for a baby who later died of SIDS.

.....

..... [1]

(ii) Use the diagram to explain how chemicals carry the impulse across the synapse.

.....

.....

.....

..... [3]

(d) Babies who died from SIDS had greater numbers of neurons which produce serotonin. Explain why the high levels of serotonin in the cerebral cortex did not stop the babies dying from SIDS.

.....

.....

..... [2]

(e) The drug ecstasy blocks the removal of serotonin.

(i) Suggest the effect of ecstasy on the gasping reflex in newborn babies.

Explain your answer.

.....

.....

.....

.....

..... [3]

(ii) Describe **one other** effect that ecstasy has on the brain.

.....

..... [1]

[Total: 14]

END OF QUESTION PAPER

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.