

Tuesday 18 June 2013 – Morning

**GCSE TWENTY FIRST CENTURY SCIENCE
BIOLOGY A**

A163/02 Module B7 (Higher Tier)

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

OCR supplied materials:

None

Other materials required:

- Pencil
- Ruler (cm/mm)

Duration: 1 hour



Candidate forename		Candidate surname	
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Centre number						Candidate number				
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INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- 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).
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- Your quality of written communication is assessed in questions marked with a pencil (✎).
- 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 60.
- This document consists of 16 pages. Any blank pages are indicated.

Answer **all** the questions.

1 Jason is concerned that he may be overweight.

- (a) He wants to calculate his Body Mass Index (BMI).
He knows that his mass is 86.0 kg and his height is 1.70 m.

The formula used to calculate BMI is

$$\text{BMI} = \frac{\text{mass (kg)}}{[\text{height (m)}]^2}$$

Use the formula to calculate Jason's BMI to three significant figures.
Show your working.

BMI = [2]

- (b) Use the result of your calculation and the table below to determine Jason's condition.

BMI reading	Condition
< 18.5	underweight
18.5–24.9	healthy weight
25.0–29.9	overweight
≥ 30.0	obese

Jason's condition [1]

- (c) Jason is concerned about the repeatability of the data he has collected and the accuracy of the equipment that he has used.
Explain what is meant by **repeatability** and **accuracy** in this case.

.....

.....

.....

..... [2]

(d) Jason knows that the greater his BMI, the greater his risk of having heart disease.

(i) Jason looks at this table of data that he sees on the internet.

BMI	Increased risk of heart disease
23–25	50%
26–29	72%

He concludes that the increased risk is reduced from 72% to 50% if the BMI is reduced from 26 to 25.

What is the problem with Jason’s interpretation of the data?
Explain your answer.

.....

.....

.....

..... [2]

(ii) Jason loses weight.

His doctor tells him that his probability of having a heart attack within the next ten years is 0.3%.

Use this example to discuss the risk to Jason, by referring to probability and consequence.

.....

.....

.....

..... [2]

[Total: 9]

2 Blood consists of many different components.

(a) The table shows the normal level of three different blood components. It also shows the level in three different people, **A**, **B** and **C**.

	Red blood cell haemoglobin g per 100 cm ³	White blood cells per mm ³	Platelets per mm ³
normal level	15	8500	250 000
person A	15	3000	255 000
person B	9	9000	245 000
person C	15	8000	130 000

What is the consequence of this data for the health of each person? Explain your answer.

person **A**

.....

person **B**

.....

person **C**

..... [3]

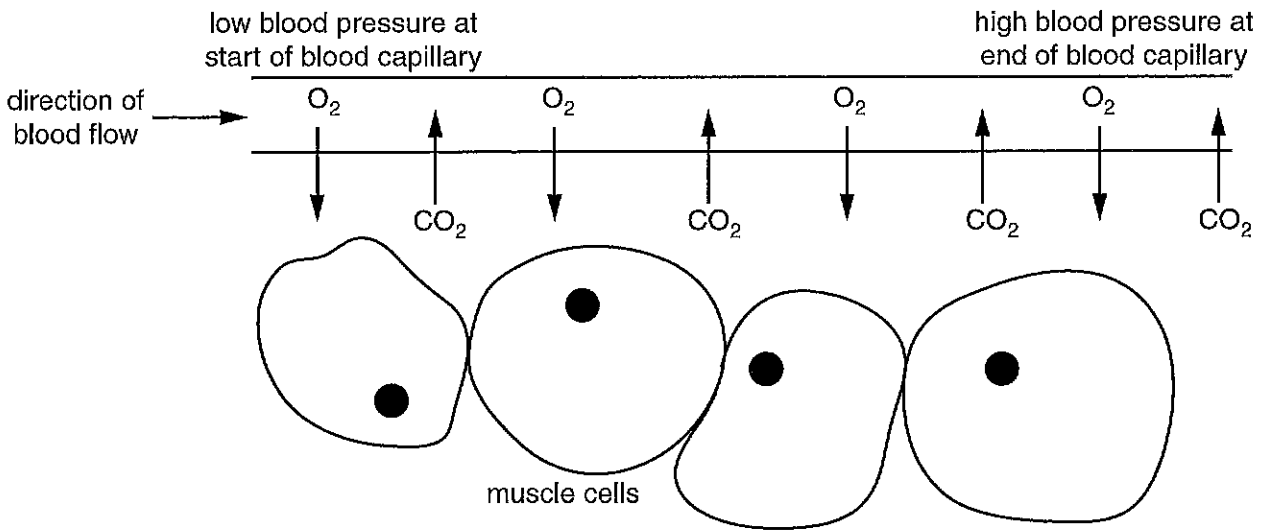
- (b) Red blood cells are adapted to the job that they do.
Draw one straight line from each **feature** to the correct **description of its function**.

feature	description of function
contains haemoglobin	only survives for six weeks
no nucleus	smaller volume to hold oxygen
biconcave shape	to bind with oxygen
	able to divide to produce new cells
	more space for haemoglobin
	hinders the red blood cells movement through the blood
	increased surface area for oxygen exchange

[3]

[Total: 6]

3 A student draws a diagram to show the movement of oxygen and carbon dioxide between the blood in the capillaries and muscle cells.



He says:

"This explains how oxygen passes from the blood to muscle cells and carbon dioxide passes from muscle cells to the blood."

Evaluate his diagram and explanation and suggest how both could be improved.



The quality of written communication will be assessed in your answer.

..... [6]

[Total: 6]

- 4 In 1774 a scientist called Sir Charles Blagden designed an experiment to test the effect of high temperatures on the human body.
The temperature of the human body is 37 °C.
Blood boils just above 100 °C.

He entered a room where the air temperature was above 127 °C.

He placed an egg and a piece of meat in the room.
The egg was cooked in 15 minutes and the meat in 35 minutes.

A student predicted that Sir Charles Blagden's body temperature would rise and he would die very quickly.

Do you think the student's prediction is correct?
Justify your answer.

.....

.....

.....

..... [3]

[Total: 3]

5 Jenny has type 2 diabetes.

- (a) Which of the following dietary factors can help Jenny to control her diabetes?
Put ticks (✓) in the boxes next to the correct answers.

- | | |
|--------------------------------|--------------------------|
| take vitamin supplements | <input type="checkbox"/> |
| have a high fibre diet | <input type="checkbox"/> |
| eat more protein | <input type="checkbox"/> |
| increase energy (food) intake | <input type="checkbox"/> |
| eat more complex carbohydrates | <input type="checkbox"/> |
| take mineral supplements | <input type="checkbox"/> |

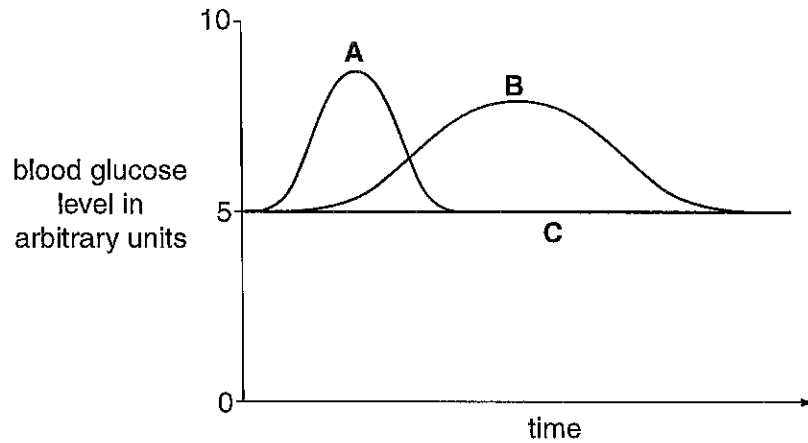
[2]

- (b) Having an unhealthy lifestyle can increase the risk of some conditions.
Which of the following conditions are most likely caused by lifestyle factors?
Put ticks (✓) in the boxes next to the **three** correct answers.

- | | |
|---|--------------------------|
| Huntington's disease inherited from mother | <input type="checkbox"/> |
| obesity | <input type="checkbox"/> |
| sore throat caused by bacterial infection | <input type="checkbox"/> |
| heart disease | <input type="checkbox"/> |
| skin cancer | <input type="checkbox"/> |
| common cold caused by a virus | <input type="checkbox"/> |
| cystic fibrosis inherited from both parents | <input type="checkbox"/> |
| colour blindness inherited from father | <input type="checkbox"/> |

[1]

- (c) Controlling glucose level in the blood is important. After eating a meal, the blood glucose level may rise and then fall back to normal. The graph shows changes in blood glucose level after eating meals containing three different foods, **A**, **B** and **C**.



Write the correct letter, **A**, **B** or **C** next to the most likely food in each meal.

type of food	letter
fibre	
glucose drink	
complex carbohydrate (starch)	

[2]

- (d) Protein in food has to be processed by the digestive system in the same way as complex carbohydrates, before entering the blood stream.

Some people with type 1 diabetes do not produce enough of the hormone insulin.

These people inject themselves with insulin.

Insulin is a protein.

Why is insulin usually injected rather than taken as a tablet?

Put ticks (✓) in the boxes next to the **two** correct answers.

Insulin in tablets enters the blood stream too quickly.

Tablets are more likely to cause infection.

Insulin in tablets is more likely to cause an overdose.

Insulin in injections will work faster.

Insulin needs to be injected straight into the pancreas.

Insulin in tablets is likely to be digested and broken down.

[2]

[Total: 7]

Turn over

- 6 Natural ecosystems are a type of closed loop system. Describe what is meant by a closed loop system and give examples to explain how human activity can unbalance ecosystems so that they no longer work effectively as closed loop systems.



The quality of written communication will be assessed in your answer.

[6]

[Total: 6]

7 It is very important that the use of natural resources by humans is sustainable.

(a) What is meant by the sustainable use of natural resources?
Put a tick (✓) in the box next to the correct description.

Resources are not taken from the environment.

Resources are used faster than they are replaced.

Resources are only used if they are urgently needed.

Resources are used at the rate at which they are replaced.

Resources are looked for in new areas.

[1]

(b) Suggest **two** ways that North Sea fish stocks could be managed in a sustainable way.

.....
.....
..... [2]

(c) Tensions sometimes exist between conserving a natural ecosystem and the needs of local people.
Suggest why this tension may exist.

.....
..... [1]

[Total: 4]

8 This question is about genetic modification.

(a) There are many examples of genetic modification.
Which of the following can be achieved by genetic modification?
Put ticks (✓) in the boxes next to the **two** correct answers.

- sexual reproduction in plants
- bacterial synthesis of medicines
- testing for genetic disorders
- selective breeding
- asexual reproduction in animals
- herbicide resistance in crop plants

[2]

(b) One example of genetic modification is the production of golden rice.
Golden rice has a gene inserted that produces vitamin A.
White rice does not contain vitamin A.
Countries with people who eat mainly white rice have high levels of blindness due to a lack of vitamin A.

Suggest why people in these countries may be more in favour of the genetic modification of organisms than people who live in the United Kingdom.

.....

.....

.....

..... [2]

9 It is important in science to understand scale. Nanotechnology involves using structures that are about the same size as small molecules.

(a) Look at the list.

- 1 cells
- 2 DNA
- 3 nucleus
- 4 nanotechnology structures
- 5 human
- 6 heart

Write the list in the correct order starting with the smallest structure and ending with the largest structure.

The first one has been done for you.

4 [2]

(b) The structures used in nanotechnology are smaller than 100 nanometres in size. A nanometre is one thousand millionth of a metre. Put a **ring** around the correct size for a nanometre.

- 0.001 m
- 0.000 001 m
- 0.000 000 001 m
- 0.000 000 000 001 m
- 0.000 000 000 000 001 m

[1]

(c) It is possible to see structures as small as 100 000 nm with the naked eye. A light microscope can be used to see structures as small as 2000 nm. To see structures smaller than that, an electron microscope is used.

A typical human cheek cell is 20 000 nm in diameter.

A virus is about 20 times smaller.

What device could be used to see a virus?

Explain your answer.

.....
.....
..... [2]

- (d) Read the article about 'smelly socks' and nanoparticles.

No more smelly socks

Scientists have developed socks that no longer smell after they have been worn. The socks are impregnated with silver nanoparticles that kill the bacteria that cause socks to smell.

A scientist said "One problem is that silver nanoparticles may be dangerous if released into the environment. We just do not know enough yet about nanoparticles."

When the socks are washed, 10% of the silver nanoparticles are released into the washing water.

- (i) Explain, using the example of the 'smelly socks', why this use of nanotechnology may not be completely safe.

.....

.....

..... [2]

- (ii) Using the example of the 'smelly socks', suggest how scientists could reduce the risk in this case.

.....

..... [1]

- (e) Some people think that goods containing nanoparticles should be labelled. This could help people decide whether or not to buy the goods. A nanoparticle is defined as a particle smaller than 100nm in size. Suggest why this definition may not be very useful when deciding whether or not to label goods containing nanoparticles.

.....

.....

..... [1]

[Total: 9]

END OF QUESTION PAPER

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Biology A

General Certificate of Secondary Education
Unit **A163/02**: Ideas in Context plus B7 (Higher Tier)

Mark Scheme for June 2013

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All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

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Quality of Written Communication skills assessed in 6-mark extended writing questions include:

- appropriate use of correct scientific terms
- spelling, punctuation and grammar
- developing a structured, persuasive argument
- selecting and using evidence to support an argument
- considering different sides of a debate in a balanced way
- logical sequencing.

Question	Answer	Marks	Guidance
1 (a)	86/1.70 ² OR 86/1.7 ² (1) 29.8 ₄ (1)	2	Any answer between and including 29 – 30 = 1 mark do not accept units / cm ² 29.8 alone scores 2 marks
(b)	overweight	1	ecf
(c)	accuracy how close to true value / correct value (1) repeatability the readings are nearly the same / close to previous reading / similar (1)	2	ignore how accurate the readings were ignore / right value / valid / precise ignore equipment gives correct results
(d) (i)	Any two from: BMI change of 26 -> 25 / 1 / which is small / which is borderline ; so change in risk would be smaller (than 22%) / idea that not everyone in range would have same risk / those higher in range would have a higher risk ORA ; Idea that risk data is averaged / mean	2	ignore ref to risk factors ignore estimate
(ii)	the risk / probability is low (1) but the consequences are high / could die (1)	2	ignore lower / decreased
	Total	9	

Mark Scheme

A163/02

Question	Answer	Marks	Guidance
2 (a)	<p>A – (low white blood cell count), likely to get infection / disease / weak immune system (1)</p> <p>B – (low haemoglobin so) anaemic / get tired easily / less oxygen / breathless (1)</p> <p>C – (low platelets so) blood not clot as quickly / bleed for longer (1)</p>	3	<p>ignore illness</p> <p>ignore pale</p> <p>ignore scabs / wounds not healing</p>
(b)	<div style="display: flex; flex-direction: column; align-items: center;"> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">contains haemoglobin</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">no nucleus</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">biconcave shape</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">only survives for six weeks</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">has a larger volume to hold oxygen</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">to bind with oxygen</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">cannot divide to produce new cells</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">more space for haemoglobin</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">helps the red blood cell move through the blood</div> <div style="border: 1px solid black; padding: 5px;">increased surface area to volume ratio for oxygen exchange</div> </div>	3	
Total		6	

Question	Answer	Marks	Guidance
3	<p>Level 3 (5–6 marks) Includes description of diffusion AND tissue fluid AND changes in concentration Quality of written communication does not impede communication of science at this level.</p> <p>Level 2 (3–4 marks) Includes description of diffusion AND tissue fluid OR Includes description of diffusion AND changes in concentration OR Includes description of tissue fluid AND changes in concentration. Quality of written communication partly impedes the communication of science at this level.</p> <p>Level 1 (1–2 marks) Includes description of diffusion OR tissue fluid OR changes in concentration. Quality of written communication impedes the communication of science at this level.</p> <p>Level 0 Insufficient or irrelevant science. Answer not worthy of credit.</p>	6	<p>This question is targeted at grades B to A*</p> <p>Relevant points include:</p> <p>diffusion</p> <ul style="list-style-type: none"> • Oxygen diffuses into cells / from blood • Carbon dioxide diffuses out of cells / into blood <p>tissue fluid</p> <ul style="list-style-type: none"> • Tissue fluid / lymph transports (dissolved) gases • Tissue fluid / lymph leaves blood at start of capillary • Tissue fluid / lymph goes back to blood at end of capillary <p>changes in concentration</p> <ul style="list-style-type: none"> • Idea of concentration gradient • More oxygen at arterial end of capillary ORA • Less carbon dioxide at arterial end of capillary ORA • Comment on high / low pressure being incorrect <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p>
	Total	6	

Question	Answer	Marks	Guidance
4	<p><i>Do not credit Yes or No</i></p> <p>Any three from:</p> <ul style="list-style-type: none"> hairs lie flat ; sweating ; evaporates / removes (latent) heat ; idea of vasodilation ; denaturing of enzymes 	3	<p>ignore cooling down</p>
Total		3	

Question	Answer	Marks	Guidance
5 (a)	<p>take vitamin supplements</p> <p>have a high fibre diet</p> <p>eat more protein</p> <p>increase energy (food) intake</p> <p>eat more complex carbohydrates</p> <p>take mineral supplements</p>	2	3 ticks = 1 mark max. 4 or more ticks = 0 marks
(b)	<p>Huntington's disorder</p> <p>obesity</p> <p>bacteria causing sore throat</p> <p>heart disease</p> <p>skin cancer</p> <p>virus causing common cold</p> <p>cystic fibrosis</p> <p>colour blindness inherited from father</p>	1	4 ticks or more ticks = 0 marks
(c)	C A B	2	3 correct = 2 marks 2 or 1 correct = 1 mark

Question	Answer	Marks	Guidance
5 (d)	<p>Insulin in tablets enters the blood stream too quickly. Tablets are more likely to cause infection. Insulin in tablets is more likely to cause an overdose. Insulin in injections will work faster. Insulin is injected straight into the pancreas. Insulin in tablets is likely to be digested and broken down.</p>	2	3 ticks = 1 mark max. 4 or more ticks = 0 marks
Total		7	

†

Question	Answer	Marks	Guidance
6	<p>Level 3 (5–6 marks) Includes a correct reference to closed loop AND explanation AND example of human activity. Quality of written communication does not impede communication of science at this level.</p> <p>Level 2 (3–4 marks) Includes a correct reference to closed loop AND explanation. OR includes a correct reference to closed loop AND example of human activity. OR includes a correct reference to explanation AND example of human activity. Quality of written communication partly impedes the communication of science at this level.</p> <p>Level 1 (1–2 marks) Includes a correct reference to closed loop OR explanation OR example of human activity. Quality of written communication impedes the communication of science at this level.</p> <p>Level 0 Insufficient or irrelevant science. Answer not worthy of credit.</p>	6	<p>This question is targeted at grades D to A</p> <p>Relevant points include:</p> <p>Closed loop</p> <ul style="list-style-type: none"> • no waste • idea of output from one part becomes input for another part • sustainable • example given <p>Examples of human activity</p> <ul style="list-style-type: none"> • fishing • emission from burning fossil fuels • palm oil / soya plantations • slash and burn / deforestation • waste / pollution • any good example <p>Explanation of how it becomes (open loop)</p> <ul style="list-style-type: none"> • consequence of removing biomass • consequence of introducing waste • reason why not sustainable <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p>
	Total	6	

Question	Answer	Marks	Guidance					
7 (a)	<p>Resources are not taken from the environment. Resources are used faster than they are replaced. Resources are only used if they are urgently needed. Resources are used at a rate at which they are replaced. Resources are looked for in new areas.</p> <table border="1" data-bbox="256 981 520 1059"> <tr><td></td></tr> <tr><td></td></tr> <tr><td></td></tr> <tr><td>✓</td></tr> <tr><td></td></tr> </table>				✓		1	2 or more ticks = 0 marks
✓								
(b)	<p>any two from: <i>idea of restrictions on:</i> number of fish taken / idea of quotas ; size / age/ species taken ; fishing at certain times / at certain places</p>	2	ignore fish farming ignore reference to need accept bans					
(c)	<p>idea that local people need the resources</p>	1	ignore want					
	Total	4						

Question	Answer	Marks	Guidance
8 (a)	<p>sexual reproduction in plants</p> <p>bacterial synthesis of medicines</p> <p>testing for genetic disorders</p> <p>selective breeding</p> <p>asexual reproduction in animals</p> <p>herbicide resistance in crop plants</p>	2	3 ticks = 1 mark max. 4 or more ticks = 0 marks
(b)	<p>idea of need or benefit (1)</p> <p>relevant comparison to UK (1)</p>	2	

Question	Answer	Marks	Guidance
(c)	<p>Level 3 (5–6 marks) Includes reference to getting the gene AND transferring the gene AND expressing the gene. Quality of written communication does not impede communication of science at this level.</p> <p>Level 2 (3–4 marks) Includes reference to getting the gene AND transferring the gene OR getting the gene AND expressing the gene. OR transferring the gene AND expressing the gene. Quality of written communication partly impedes the communication of science at this level.</p> <p>Level 1 (1–2 marks) Includes reference to getting the gene OR transferring the gene OR expressing the gene. Quality of written communication impedes the communication of science at this level.</p> <p>Level 0 Insufficient or irrelevant science. Answer not worthy of credit.</p>	6	<p>This question is targeted at grades D to C</p> <p>Relevant points include:</p> <p>Getting the gene</p> <ul style="list-style-type: none"> • identify gene • isolate gene • replicate gene <p>Transferring the gene</p> <ul style="list-style-type: none"> • put gene into vector • example of vector eg virus, aerosol / plasmid / phage • explanation of how insertion occurs <p>Expressing the gene</p> <ul style="list-style-type: none"> • idea that DNA is common in all organisms <p><i>in humans</i></p> <ul style="list-style-type: none"> • transferred gene makes Factor 8 <p><i>in bacteria</i></p> <ul style="list-style-type: none"> • transferred gene makes Factor 8 • bacteria reproduce • isolate / purify F8 / give people F8 • <p>If they inject bacteria into human, then max L2</p> <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p>
	Total	10	

Question	Answer	Marks	Guidance
9			
(a)	2 before 3; 3 before 1; 1 before 6; 6 before 5	2	2 or 3 steps correct for 1 mark 4 steps correct for 2 marks 23165 = 2 marks
(b)	0.001 0.000 001 <u>0.000 000 001</u> 0.000 000 000 001 0.000 000 000 000 001	1	
(c)	virus is 1000 nm (in diameter) (1) therefore need <u>electron microscope</u> (1)	2	accept less than 2000nm ignore "need to use a more powerful microscope"
(d)	(i) not enough is known about nanoparticles (1) (10% are) released when socks are washed / into washing water (1)	2	ignore "may not be completely safe"
	(ii) make them so none / less are released when washed	1	ignore use less nanoparticles
(e)	Idea that 101 nm may be just as dangerous as 99 nm	1	
	Total	9	
	Paper Total	60	

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