Science in the News Question Feedback and Guidance

JANUARY EDITION

This document provides the mark schemes and additional written feedback to support each question in January's edition of the Science in the News. The answers aim to support students develop exam technique and provide additional tips on how to succeed in these styles of questions in an exam.

Phages – Question Mark Scheme				
	Answers	**Extra Guidance**	**Mark**	**Skills Addressed**
Q1	**Level 1**: One clear argument supporting the abandonment of phages OR one clear argument against.	Arguments in support: • Penicillin / antibiotic more likely to be successful • Phages are very specific / the right phage must be found for a (particular) bacterium • Penicillin / antibiotic not so specific / can kill a wider range of bacteria Arguments against: • The full potential of phages should have been explored • (it should have been anticipated that) antibiotics also kill beneficial bacteria / phages carry fewer risks • (it should have been anticipated that) antibiotic resistance might develop	**1-2**	**WS 1.1, 1.3, 1.4**
	Level 2: One clear argument supporting the abandonment of phages AND one clear argument against.		**3-4**	
	Level 3: A detailed and balanced discussion containing at least two pairs of matched arguments AND a clear conclusion / opinion.	Matched arguments: • (Although) antibiotics were more useful, the full potential of phages should still have been explored • (Whereas) an antibiotic can treat a range of bacterial infections, each phage can be used to treat a small number of bacteria only • (While) an antibiotic might also kill beneficial bacteria, phages kill only the targeted bacteria Conclusion: You clearly agree or disagree with the abandonment of phages, with your opinion reflecting your argument (if it leans one way or the other)	**5-6**	
The mark scored in each level depends on the clarity, with the higher mark in each level being awarded for a clear sentence or statement.				
TOTAL = 6 marks				
Additional Question Feedback and Guidance Most of the information needed to answer this question is to be found in the text of the question and so value is added to that information by organising it to make a clear and balanced argument. The idea of antibiotic resistance is not mentioned in the text of the question but bringing it into your answer can gain credit. In similar questions there might be more opportunities to bring in your own prior knowledge that should be looked out for.				

Pollution in India – Question Mark Scheme				
	Answers	**Extra Guidance**	**Mark**	**Skills Addressed**
Q1	1 μg/m^3 = 0.000001 g/m^3 or 1.0 x 10^{-6} g/m^3		**1**	**WS 4.4**
	1 μg/m^3 is more convenient / easier to use		**1**	
TOTAL = 2 marks				
Q2	The (PM2.5) concentration is always (much) higher than the WHO recommendation		**1**	**WS 3.2, 3.3**
	At its lowest / at 10:00 on Dec 30 the concentration is (about) 24 times greater than the recommendation	For both marks to be scored the number of times greater must be calculated correctly. One mark can be scored for two correct differences – 230 at 10:00 on Dec 30 and 450 at 15:00 on Dec 30 Both marks can be scored for alternative times if it is made clear that the concentration varies widely and the times and dates are stated.	**1**	
	At its highest / at 15:00 on Dec 30 the concentration is (about) 46 times greater than the recommendation		**1**	
TOTAL = 3 marks				
Q3	The concentration falls from a maximum of (about) 450 μg/m^3 at 22:00 on Dec 29 or 01:00 on Dec 30 TO a minimum of (about) 240 μg/m^3 at 10:00 on Dec 30 AND then rises again.	All detail needed for this mark.	**1**	**WS 3.5, 3.6**
	Any two reasonable explanations	Reasonable explanations: • There are fewer cars on the roads in the middle of the night – the roads are busier in the mornings, afternoons and evenings • Less cooking / heating takes place in the middle of the night – stoves are used more in the mornings, afternoons and evenings Allow other reasonable explanations not mentioned in the text of the question such as less electricity generation or less industry in the	**2**	

		middle of the night, but NOT less stubble burning.		
TOTAL = 3 marks				
Q4	The (PM2.5) concentration decreases from a maximum of about 205 µg/m^3 (accept 200 or 210) in January to a minimum value of (about) 40 µg/m^3 in July, August and September before rising again to 220 µg/m^3 in December	All detail needed for this mark Ignore any reference to the peak in June here – marks are available for explaining it.	**1**	**WS 3.5, 3.6**
	Any two reasonable explanations	Reasonable explanations: •Lower temperatures mean more stoves are used / more (solid) fuel is burned in December and January •Stubble is burned in November and December Allow other reasonable explanations not mentioned in the text of the question such as rain washes PM2.5 pollution from the atmosphere in the middle of the year or Diwali celebrations involving fireworks in November, but NOT less cooking or fewer cars in the middle of the year. Allow a reasonable explanation for the peak in June for one mark – an increased use of air conditioning leading to more electricity production.	**2**	
TOTAL = 3 marks				

Additional Question Feedback and Guidance

Question 1: In order to answer this question, you must know the meaning of the symbol 'µ' – micro and understand that symbols like this are a form of short hand designed to be more convenient that sometimes long numbers.

Question 2: To obtain full marks on questions like this you must carry out a detailed analysis of the given information and the most effective way to do this is to work out factors of multiplication. Stating that one value is a certain number times greater than another is more powerful that simply stating the difference – for example, stating that the concentration is (about) 24 times greater than the recommendation (240 vs 10) at 10:00 on December 30th is more powerful than just saying it is 230 µg/m^3 higher than the recommended value.

Questions 3 and 4: Most of the information needed to answer these questions is to be found in the text of the questions and so value is added to that information by organising it to make clear and balanced arguments. However, your own prior knowledge can be used if it is correct, or at least not obviously incorrect. For example, for question 3 it is not unreasonable to assume that industry produces PM2.5 pollution and that this will be less busy at night. However, it is not reasonable to assume that stubble fires in neighboring states will be extinguished at night. For question 4 you may have knowledge of India and its customs, such as Diwali and if it provides a reasonable explanation it can be used. However, there is no evidence to suggest that fewer cars will be on the road or less food will need to be cooked.

Broadband Options – Question Mark Scheme				
	Answers	**Extra Guidance**	**Mark**	**Skills Addressed**
Q1	1000 ÷ 66	Allow 1.0 x 10^9 ÷ 66 x 10^6 or any correctly corresponding pair of values	**1**	**WS 4.4 – 4.6**
	= 15	Allow 15.2 or 15.15 but not any more significant figures or incorrectly rounded values. Answer on its own scores both marks.	**1**	
TOTAL = 2 marks				
Q2	**Level 1**: States one advantage of a system AND one disadvantage of a system – not necessarily the same systems	Advantages of ADSL system: • It is the cheapest • Much of the infrastructure / equipment is in place Disadvantages of ADSL system: • It is the slowest • It is (8/66) ≈ 0.12 or 1/8th the speed of FTTC • It is (8/1000) ≈ 0.008 the speed of FTTP (approximately 100 times slower) • Copper wires are bulky • Fewer devices can be used at any time • More repeater stations needed Advantages of FTTC system: • It is about 8 times faster than the ADSL system • It is cheaper than the FTTP system • Some of the infrastructure / equipment is already in place • Fewer repeater stations than the ADSL system needed • More devices can be used at any time than with the ADSL system Disadvantages of FTTC system: • Fewer devices can be used at any time than with the FTTP system Advantages of FTTP system: • The fastest system / allows far more devices to be used at any time • Fewer repeater stations needed	**1-2**	**WS 1.4**
	Level 2: Correctly identifies two advantages and two disadvantages of the same system		**3-4**	

		• Optic fibre less bulky Disadvantages of FTTP system: • All infrastructure / equipment must be replaced • It is more expensive		
	Level 3: Makes a detailed comparison of at least two of the systems using matching pairs of arguments	Matching pairs of arguments: • The ADSL system is already in place and ready to use in the short term, but in the longer-term users will want to connect more powerful devices to the system and so we will need to go to FTTP • Optic fibre is much more expensive than copper wire … but savings will be made because it requires fewer repeater stations • … and fewer fibres will be needed as they can carry more information • … and less space will be needed to channel them • FTTC is a good compromise while FTTP is rolled out.	**5-6**	
TOTAL = 6 marks				

Additional Question Feedback and Guidance:

Question 1: In order to answer this question, you must know the meaning of the symbols 'M' – mega and 'G' – giga and be able to use them in calculations.

Question 2: The information needed to answer this question is to be found in the text of the question and so value is added to that information by organising it to make clear and balanced arguments. It is relatively easy to pull information out of the question text and simply quote it to achieve Level 1. However, to achieve Level 3 you need to add value to the information and use it in balanced, well-constructed arguments. To achieve full marks in questions like this it is important that like is compared to like. For example, the mitigation of the higher cost of optic fibre by the ability to carry more information and the need for fewer repeaters makes two good points.