OCR GCSE Science A: Ideas about Science in student-speak

Caution

The IaS 'student speak' statements here have been rigorously checked, yet they still cannot replace the OCR statements when preparing students for OCR assessment units.

Writing student-speak versions of the IaS statements is perilous. There are several difficulties to overcome, in particular the following.

- Over-simplification of a statement may result in its meaning being lost or distorted.
- For some statements it is tempting to provide too much detail in the student-speak version, that is to begin teaching the meaning rather than simply restating it in a way you hope students will find more accessible.
- Technical language, which students need in order to correctly express ideas about science, may be inadvertently removed from the statements.

Ranking in order of difficulty

The IaS statements are shown in a rank order, indicating those which students might find straightforward, and those which might be more challenging. Higher Tier statements are in bold.

However, the difficulty of IaS outcomes may vary depending on the context in which they are being applied, as well as between students themselves.

The ranking is therefore only intended as a starting-point for science departments, to assist with the development of success ladders for students.

Acknowledgements

This chart with 'student speak' statements was developed as part of a project initiated by a group of Twenty First Century Science teachers, meeting first in October 2006 to discuss how Assessment for Learning (AfL) approaches could be applied to the teaching and learning of Ideas about Science. The group was convened by Peter Robinson, SNS consultant for Bury LA, and Jenifer Burden, Co-director for Twenty First Century Science at the University of York Science Education Group.

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LEVEL OF DIFFICULTY →

Can identify any outliers in a set of data.	Uses data rather than opinion in justifying an explanation.	Can suggest reasons why several measurements of the same quantity may give different results.	Can give reasons for including or discarding outliers.	**Can justify the claim that there is/is not a 'real difference' between two measurements of the same quantity.**
I can spot any outliers in data I have collected or been given.	I always use data (measurements and observations) to back up a scientific explanation, or to explain why I think an explanation is wrong.	When I measure the same thing several times, the results may be different. I can give reasons for this.	When I have a set of data, I can explain why I have decided to ignore some measurements, or to keep them in even though they are outliers.	**Measurements of the same thing under different conditions may not be the same. I can explain whether I think this shows a real change by looking at: (i) the size of the difference; (ii) the ranges of the two sets of measurements.**
	Can suggest reasons why a measurement may be inaccurate.	Can calculate the mean of a set of repeated measurements.	Can make a sensible suggestion about the range within which the true value of a measured quantity probably lies.	When asked to evaluate data, makes reference to its reliability (i.e. is it repeatable?)
	I can give reasons why you don't always get exactly the right answer when you measure something.	I can work out the average (mean) of several measurements of the same thing.	By looking at the lowest and highest values in a set of measurements of the same thing, I can tell you the range that the true value probably lies within.	When I judge how good a measurement is, I look at whether or not it can be repeated to see if it is reliable.
		From a set of repeated measurements of a quantity, uses the mean as the best estimate of the true value.	Can explain why repeating measurements leads to a better estimate of the quantity.	
		I would use the mean of several measurements of the same thing as my best estimate of its true value.	I can explain why repeating measurements of something will give me a better idea of what its real value is.	

LEVEL OF DIFFICULTY →

In a given context can identify the outcome and the factors that may affect it.	Can give an example from everyday life of a correlation between a factor and an outcome.	Can explain that individual cases do not provide convincing evi-dence for or against a correlation.	**Can explain why a correlation between a factor and an outcome does not necessarily mean that one causes another…**	… and give an example to illustrate this.
I can say what the outcome we are interested in is, and identify some factors that might affect it.	I can give an example from everyday life of a correlation between two things.	I know that one example is not enough evidence to decide whether or not there is a correlation between two things.	**I can explain that even when there is a correlation between two things, this doesn't necessarily mean that one is causing the other. Something else might be causing them both….**	… and I can give an example to show this.
In a given context can suggest how an outcome might be affected when a factor is changed.		**Can use data to develop an argument that a factor does/does not increase the chance of an outcome.**	Can suggest factors that might increase the chance of an outcome, but not invariably lead to it.	**Can identify the presence (or absence) of a plausible mechanism as significant for the acceptance (or rejection) of a claimed causal link.**
I can say how I think the outcome would change when one factor is changed.		**I can use data to argue that a factor affects an outcome – or to argue that it doesn't.**	I can suggest factors that may increase the chance of something happening. I recognise that even with these factors it may still not happen.	**If someone claims that something is the *cause* of an outcome, I know that this is more believable if there is also a good explanation for the link between them (a *mechanism*).**
Can identify in a plan for an investigation the fact that other factors are controlled as a positive feature, or the fact that they are not as a design flaw		**Can explain why it is necessary to control all factors thought likely to affect the outcome other than the one being investigated.**		Can evaluate the design for a study to test whether or not a factor increases the chance of an outcome, by commenting on sample size and how well the samples are matched.
I can judge how good an investigation plan is by seeing if factors we are not testing have been controlled (good) or not controlled (bad).		**I can explain why it is important in an investigation to control all the factors apart from the one I want to change.**		To test if a factor increases the chance of an outcome, we may compare two groups, e.g. affect of smoking on risk of lung cancer / To evaluate this sort of study, I look at the size of the groups and how well they are matched.

LEVEL OF DIFFICULTY →

Can identify statements which are data.	Can identify statements which are all (or part) of an explanation.	Can recognise data or observations that are accounted for by an explanation.	Can justify accepting or rejecting a proposed explanation on the grounds that it accounts for observations.	**Can justify accepting or rejecting a proposed explanation on the grounds that it links things previously thought to be unrelated.**
When I read about something in science, I can identify the statements which give me some data.	I can identify statements which are putting forward an explanation.	I can spot data that support an explanation.	When I evaluate a scientific explanation, I say how well it explains the observations scientists have made.	**When I evaluate a scientific explanation, I look at whether it links things that scientists have not connected before. If it does, I know we can be more confident about the explanation.**
Can identify creativity and imagination in the development of an explanation.	Can recognise data or observations that conflict with an explanation.	Can identify a scientific question for which there is not yet an answer.	Can justify accepting or rejecting a proposed explanation on the grounds that it leads to predictions that are subsequently confirmed.	Can recognise that when an observation disagrees with a prediction (derived from an explanation) that this shows that either the observation or the prediction is wrong, and that this may decrease our confidence in the explanation.
I can say where people had to use creativity and imagination to come up with an explanation.	I can spot data that disagree with an explanation.	I can identify a question that science might be able to answer (a scientific question). I can identify a scientific question for which there is not yet an answer.	I can identify examples of predictions that scientists have made, based on a scientific explanation. When I evaluate a scientific explanation, I look for examples of predictions that have later been confirmed. I know that these make us more confident about the explanation.	I can tell where new evidence does not match a prediction made by scientists. This means that either the prediction or the observation is wrong, so we should be less confident about the explanation.
			Can identify a scientific question for which there is not yet an answer, and suggest a reason why.	Can recognise that when an observation agrees with a prediction (derived from an explan-ation) it increases our confidence in the explanation, **but does not prove it is correct**.
			I can identify a scientific question that scientists have not yet been able to answer, and suggest a reason why.	I can tell where new evidence agrees with a prediction made by scientists. This means we can be more confident about the scientists' explanation, **but does not *prove* it is correct.**

LEVEL OF DIFFICULTY →

Can identify absence of replication for questioning a scientific claim.	Can recognise that new scientific claims which have not yet been evaluated by the scientific community are less reliable than well-established ones.	Can describe in broad outline the peer review process, in which new scientific claims are evaluated by other scientists.	Can suggest plausible reasons why scientists involved in a scientific event or issue disagree(d).	**Can suggest reasons for scientists' reluctance to give up an accepted explanation when new data appear to conflict with it.**
I can say why doing a test or experiment only once is not as good as repeating it. I know that a scientific claim is stronger if other scientists can get similar data.	I can see why results that have been checked by other scientists can be trusted more than those that haven't.	I can describe how scientists check each others' work by a process called 'peer review'.	I can give reasons why scientists may disagree about some data or explain the same data differently.	**I can give reasons why scientists might not want to change their ideas, even if new data don't support these ideas.**
			Can explain why scientists regard it as important that a scientific claim can be replicated by other scientists.	
			I can explain why a scientific claim is more likely to be accepted if several scientists have done similar investigations and got results that agree.	

LEVEL OF DIFFICULTY →

Can identify examples of risks that arise from a new scientific or technological advance.	Can explain why it is impossible for anything to be completely safe.	Can interpret and discuss information on the size of risks, presented in different ways.	**Can discuss a given risk, taking account of both the chance of it occurring and the consequences if it did.**	**Can propose an argument based on the 'precautionary principle'.**
I can give examples of risks from a new scientific or technical advance, e.g. IVF, the internet, man-made fats in food.	I can explain why every activity carries some risk, even though this may be very small.	I can judge how big a risk is, using information presented in different ways.	**When I discuss a risk, I take account of:** **• the chance of it happening,** **• how bad the effects would be if it did happen.**	I can put forward an argument that is based on the 'precautionary principle'.
Can suggest ways of reducing specific risks.	Can suggest benefits of activities that have a known risk.	Can discuss personal and social choices in terms of a balance of risk and benefit.	**Can distinguish between actual and perceived risk when discussing personal and social choices.**	**Can explain what the ALARA (as low as reasonably achievable) principle means.**
I can suggest ways of reducing a particular risk.	I can suggest benefits of activities that have a known risk.	I can suggest reasons for choosing whether to do something, by weighing up the risks and benefits.	**I can tell the difference between perceived and actual risk.**	**I can explain what the ALARA (as low as reasonably achievable) principle means.**
	Can explain reasons for people's willingness (or reluctance) to accept the risk of a given activity.	Can identify an argument based on the 'precautionary principle'.	Can suggest reasons for given examples of differences between actual and perceived risk.	Can apply the ALARA principle to a given context.
	I can suggest why someone who knows the risk of a particular activity may (or may not) go ahead with it.	I can spot when someone is using the 'precautionary principle' to decide what to do in a certain situation ("when risk is uncertain, better safe than sorry!").	I can suggest reasons why people might think the risk of something is bigger (or smaller) than it actually is.	I can use the ALARA principle in a particular situation.

LEVEL OF DIFFICULTY →

Show awareness that scientific research and applications are subject to official regulations and law.	In a particular context, can identify the groups affected and the main benefits and costs of a course of action for each group.	In a particular context, can identify arguments based on the ideas that the right decision is the one that leads to the best outcome for the majority of people involved; certain actions are never justified because they are unnatural or wrong.	In a particular context, can develop arguments based on the ideas that the right decision is the one that leads to the best outcome for the majority of people involved; certain actions are never justified because they are unnatural or wrong.	**In a particular context, can distinguish what can be done (technical feasibility) from what should be done**.
I know that there are laws and regulations controlling scientific research, and the uses of science.	I can work out which groups of people are affected by something, and what the benefits and costs are for each group.	I can identify when people are saying that: • the right decision is the one that helps the most people or: • some actions can never be allowed because they are unnatural or wrong	I can put forward arguments that: • the right decision is the one that helps the most people or: • some actions can never be allowed because they are unnatural or wrong	**I can separate arguments that are about what is possible (what we *can* do) from those that are about what we *should* do.**
Where an ethical issue is involved, can say clearly what the issue is.	Where an ethical issue is involved, can summarise different views that may be held.	Can distinguish questions which could not be addressed using a scientific approach, from questions which could not.	Can explain the idea of sustainable development.	**Can explain why different courses of action may be taken in different social and economic contexts.**
I can identify the ethical issue in a particular situation.	I can describe different views people may have about an ethical issue.	I can tell the difference between scientific and non-scientific questions.	I can explain what is meant by 'sustainable development'.	**I can explain why people may reach a different decision about the same issue, because of differences in where they live, their experiences, or how well off they are.**
				Can apply the idea of sustainable development to specific situations.
				I can discuss whether or not a development is 'sustainable'.