Science – Investigating science – Examination tips transcript

(Duration 30 minutes 54 seconds)

(upbeat music)

Welcome to our Investigating Science HSC hub. I have created this presentation to help you with the problem set and to organise the ideas, in relation to the skills that you need to answer the HSC questions.

So I will start with the acknowledgement of the country, I would like to pay my respects and acknowledge the traditional custodians of the land on which this meeting takes place and your meeting takes place in your schools and school settings. And I pay my respect to Elders both past and present.

So, as I said, this is a little bit of the skills that you will need to answer your HSC exam. So how to do things, to reach that band sixes, and to reach your full potential in the exam. So I'm going to start with some general tips to answer the HSC questions. For sure your teachers, and you teachers are telling your students this over and over again, right? The first thing is read the question properly. When you are going to answer the questions, take your time, you have time during the reading time, and you have time when you are doing your exam to read the question properly. You need to start with the stem of the question, and in the case of the multiple choices, pay attention to the wording. Because it's just key words in there that they're going to tell you if the question is based on skills or the question is based on content. And we're going to go through this during the presentation. Another thing is know how to answer the verb of the question. It's not the same when you are having a describe question or explain question or a justify question. Different verbs are going to require different components in the answer. And they are going to have different distinctive, specific wording in those answers. And the marker will look for that. To put that extra, tick on your question. You can create a draft of the question on the side margin. That is not a problem. Or within the writing of the question. You can make dot points or you can make a tiny flow chart, or you can make, something that it will organise your brain to later on construct the question in the way that it should be. Keep an eye on the plurals. There are many, many students that write beautiful answers. And because they didn't put two examples or they didn't refer as, with the stimulus in two ways, all right? So please read the plurals of the questions. And I'm going to indicate that during the presentation as well.

When you are answering the question, refer to the stimulus presented to you. If that is stimulus is a text or is a diagram, or is a graph, or is a figure, in your answer, you should say, as per the figure presented or as is indicated on the diagram, right? So, you have to refer to that stimulus. Make sure you address all the skills required. What that means, when you are constructing a table, keep an eye on the headings. The question can say, construct a table. It can say tabulate. It can say plot, if you are doing a graph. So just keep an eye on what you have to do with the question. If you have to do a graph, I'm going to go through detail in there as well, all the details around the graph. And if you have to annotate a diagram, you need to put in that diagram, all the steps that is happening in that diagram, all the content that is related to that diagram. And I'm going to go through that as well. And when you are writing hypothesis, conclusion, planning and analysing investigations. All those are skills that you need to practice, using previous papers, using this problem set. So when you are coming in front of the exams, this becomes an automatic response that, "Oh yeah, I know that that question refers to "making an hypothesis or analysing an investigation "or making a graph or making a table. "And I know how to make those graphs and tables."

Okay, when you're going to build up that answer this is how you are going to build up answers when you are practicing. Choose a content, choose a skill and start from the bottom. Describe that content or describe that topic. It's just the characteristics. And then when you move up, it will go to the explanation of that diagram or the explanation of that table, or the explanation of that figure should be a cause and effect relationship. This is happening because this is happening. Then we move up to another level of the verbs, , which is analyse. When they're asking you to analyse a graph, analyse a table, analyse an investigation, you have to put in there, the relationship and implications of those components. And I'm going to give examples as well with specific questions. And then if the question is asking you to assess that investigation, you have to make a judgment. The marker will look for that sentence that it says, this investigation has increased the knowledge and understanding of, or this investigation has increased the understanding for future research. If you do not put a judgment, your question will fall with maybe the marker has to put two, three marks down because there is no judgment. So keep that in mind.

Here is how you are going to reach that band six with your vocabulary in your answer. If you're in a band four level, your scientific skills are good. You know what to do, you know what to do in a graph. You know that you can use some scientific terms. You can communicate well, and you can apply your knowledge relevant to what is presented to you. That is called a sound knowledge, sound skills. Yeah, this is effective, but it's not wow. Now to move to the band five, those scientific concepts and skills have to be integrated into a more complex answer. It's not just, "Oh yeah, I know what to do." It is, "I know what to do with this graph because I can annotate the graph and analyse it." And I can apply my knowledge and my skills into a situation that I never ever have been presented before. When we are reaching the band six, your level of skills, understanding knowledge has to be really high to integrate and correlate those ideas and those skills. Your communication has to be succinct. Clear, concise, no rubbish in there, no wishy washy in there. And you have to have a comprehensive solution for any unfamiliar issues that is presented to you. In your exam they're going to be stimulus, graph, maps, diagrams that your teacher never ever, show you in the class. And that is okay, all right? Because the exam, wants you to think and to apply your knowledge and your skills. Your teacher will give you all the skills. He will teach you all the skills and you need to learn all that, and you have to have that applicability to the next level, too unfamiliar situation, which is a band descriptor.

All right, let's start working with some of the examples. This is coming from module five. And this sample is from the Investigating Science problem set that is available in the HSC hub. And this is one question that is going to need your skills to assess a methodology. “Assess the appropriateness of the methodology that Marshall and Warren use for, to investigate into the cause of peptic ulcers.” So let's deconstruct the question a little bit. You have assess, that means straightaway that you have to put a judgment in your answer. So you can circle that word. Now you can circle this here, assess and say, and write judgment. Appropriateness, what that means? Meaning is a suitable methodology with best practice. You know that Marshall and Warren did a great methodology, but there were some ethical issues with the research. So, what is methodology? Methodology is not only the steps that they did to reach that conclusion. To reach the conclusion of the experiment. It's not only the procedure, it's all related to the validity, the reliability, the safety involved. So the methodology, they are all the steps of the planning of the investigation, of the conducting of the investigation until you reach the conclusion. That includes everything, not just the procedure. Another thing is, it says in the question is investigate. Investigate means plan, inquire into and draw conclusions about it. So that investigation, you have to put a conclusion, what's happening at the end of this experiment. Did they reach the answer? What about what caused peptic ulcers?

Okay, so this is a marking criteria for this question. And then we are coming back to the slide of thorough, extensive, sound. You can say in there, they must write a thorough understanding of the work and provide a thorough assessment of the various aspects of the methodology. If you cannot provide that you are straightaway dropping one or two marks to a sound understanding. Well, you're going to have an answer that, yeah, it's good enough, but it's not perfect for that top mark.

[See support document- Investigating science Year 12 modules Problem Set]

So let's see the example, here is the example provided by the problem set. And you can see that the answer is divided into paragraphs, which is okay. You don't need to write 20 page essay. So the first paragraph is the introduction of the topic. Describe the context. The second paragraph is in where they were planning. They were inquiring, they were having all those observations. They were collecting data. They are going to have the validity and reliability of the, and the safety of the experiment. So, they see that they can observe the presence of the bacterium. They realise that it was not alone to determine that the bacteria by itself caused the peptic ulcers. So, this is making, okay, yes, we have all these data but, what's happening? So, they were having a lot of biopsies that is a repetition of the experiment, of the data. Then it goes to the suitable methodology for best practice. And then you have in that sentence that he says, infecting humans with potential harmful pathogen is not considered ethical. So, they couldn't use humans to investigate further. So, then it moves out of that best practice. And then Marshall ingested the organism, okay. That was not ethical. That was unconventional. And you put a sentence in there that it was unconventional. And then you put a sentence in there that he was criticised, but he helped with the discovery. That is the assessment. You can see that in each of the paragraph, there are sentences in there that add value. The procedure helped with the discovery, further investigation confirm the link. So those are the values in there. You make the judgements, the quality of the work and the conclusion that it was reached. To write an answer like this, you need practice. Practice and practice. Cool, moving on with another example.

[See support document- Investigating science Year 12 modules Problem Set – Module six sample answer part a]

This one is about the skills of graphing. And demonstrate your ability to show data and to interpret data and to manipulate data. So in this case, the question is, showing you a table, different temperatures and at different temperatures, the oxygen level at that temperature. The question is asking you to just plot the data. And it's only three marks. So, I just moving on and I say, All right, fantastic, this is a simple graph, but you have to have a title. You have to have the axis label, oxygen and temperature, and the unit. If you put temperature on the vertical axis or the y-axis or vice versa, that is a zero, why? Temperature is your independent variable. It's the variable that you are changing. You are changing, you the researcher, you are manipulating this. That goes always in the x-axis. The oxygen levels is what you are measuring. That means it's your dependent variable. And it goes in the vertical axis, the y-axis. Then you plot the graph. You have all your dots and you try to put the line of the best fit. Sometimes the question is going to ask you to annotate the graph. When you have to annotate the graph, you have to circle or indicate in the graph what's going on. So for example, if I have to annotate this graph, I will circle this top section of the graph. And I can say lower temperatures, higher concentration of oxygen. And I can put an explanation in there if it's needed.

So in the marking criteria, it says axis label, points plotted with minimal error, means that at 20 is nine not 10. It is a line graph. If you do a column graph, it will be zero. However, if you have a column graph and all these labels are correct. Maybe the marker will give you one mark. So, it all depends how the marker centre decide about having a column graph or not. Fair enough, we move on for part B of this question.

[Slide reads
b).Propose and explain a hypothesis for the investigation (two marks)

Marking criteria(b)
Sample answer: As the water temperature is increased, the level of dissolved oxygen will decrease. This may be due to the movement of heated water molecules that allow less room for dissolved oxygen molecules to exist in the spaces between the water.]

The part B is asking you to propose and explain an hypothesis. So the only stimulus that you have in here is this, the table shows the results of a practical investigation.[ [Screen briefly displays support document- Investigating science Year 12 modules Problem Set – Module six sample answer part a] With the effect of temperature on dissolved oxygen in water. So you don't have anything else. So to create an hypothesis, you have to observe that graph. You have to observe that table and say, Okay, “As the water temperature increase, the level of dissolved oxygen will decrease." That's it, that is your hypothesis. However, the question says, explain, propose and explain. So you write your first sentence will be your hypothesis. Your second sentence is why that is happening. “This may be due”, still in a hypothetical way “to the movement of heating water particles” and you explain what's happening when particles are heated, the space between them are expanding and there is less room for dissolved oxygen molecules. So you explain a little bit of the chemistry behind. If you just put the hypothesis without reasoning, it will be one mark. Just one sentence in there with the hypothesis. So please do not leave questions blank. Because any information that you put in there that is sort of relevant, it will give you one mark. And that can be the difference between your band four or your band six or band five.

[See support document- Investigating science Year 12 modules Problem Set – Module six question and sample answer and marking criteria part c]

Okay, part C of that sample, is justify reasons why an electronic probe to measure the dissolved oxygen is used. So in this case justify, again we have to make a judgment. We need to know the differences of technologies when we are collecting data in an investigation. And this refers to the precision and accuracy of the technology. That is what is in their marks. Provide two reasons, the benefits of using the probe, the accuracy and precision of measurement and if it is easy to use. And if you have provided only one reason, okay, one mark, but coming back to one of my first slides, justify reasons, two reasons. It's a plural in there, okay? And you can see that this is a two-mark question, but it's because of the verb and the plurals and what you have to compare is a question that it can address a band six descriptor. So maybe you never use an electronic probe. That's okay, but you know what is accuracy. But you know what is precision. And you know, that electronic probe will be more accurate and more precise than just a simple colour indicator that is a subjective type of technique.

[See support document- Investigating science Year 12 modules Problem Set – Module six question and sample answer and marking criteria part d]

Good, moving on. The part D of the question is implication of this results for fish living in those shallow waters in central Australia. Now, this is a question targeting that band descriptor on your skills to apply your knowledge, understanding and skills into an unfamiliar situation. Maybe your teacher never, ever talked about this, but you know, with the build up in the question, with the table, the graph, the using of the probe, the explanation of the hypothesis, what can happen to those fish. Again, it's only two marks. So provide a suitable implication for the survival of the fish and explain how high temperatures and dissolved oxygen is going to be available in the water. So shallow waterways in central Australia could be prone to extreme temperature changes. It is in the desert. Those little water pools, in between rocks or whatever, little creeks. If the water gets too warm mean dissolve oxygen becomes very low. You can even refer in here to the graph that you did in the previous question, why we need oxygen? It's essential for these fish. So you need to be able to apply those things into unfamiliar situations.

Okay, we're coming back now to a question from an exam paper, that I want to talk about this because the wording is really important. And when we were analysing the examination paper last year, this was one of the questions that the wording was very difficult. This question said, “Discuss two types of misuse of scientific evidence by the tobacco industry in relation to lung cancer. Support your answer with an example of each type of misuse”, seven marks. So let's see, and deconstruct this. Discuss two types of misuse of scientific evidence. So you need to be very clear what misuse means, to answer this question. This is a proper outcome, it's outcome 12, 12-14, and 12-15. And there is actually a content statement related to this in the syllabus.

Now what misuse means, these are three things that misuse means. Misinterpretation of research. Means that that research is not understood properly or that means research is not interpreted in the way that intended to. This could be misinterpretation of results, misinterpretations of models, misinterpretations of conclusions from that research. Misrepresentation of research is when you're using that research and you manipulate that research by your own benefit. You distort the data, you twist it a little bit. So it suits your intention. Can you see the differences between the two? Misinterpretation is that you didn't get it, you didn't understand. There is no bad intentions in here. Misrepresentation is when the data or the research is used by your own benefit. And then the suppression right of that research is when that research is subdued due to political societal or economic reasons. So that means for example, or we cannot publish that because the government is going to cut off our money. Or remember in the 16th century, 15th century, when a lot of research was not published because that was against the society beliefs of the time. So this has to be very clear when we having the word misuse. Maybe in the paper this year, will say misinterpretation or misrepresentation or suppression. I don't know. But keep this vocabulary in mind.

This is the marking criteria for the question. This is coming from the marking centre. This is the way that question was marked in 2019. So the marker will receive these marking criteria and he has to apply it consistently across all of you when you are marking. So look at this, for seven marks, you have to have examples of misrepresentation and/or misinterpretation and/or suppression. Because the question says two misuses. You can have one, you can have two of these in that you have to describe the issues related to those and a coherent discussion of those issues.

[Slide reads: 2019 HSC Question 28
Sample answer:
There was a conflict between the tobacco industry and knowledge of tobaccos link to lung cancer. If it became widespread public knowledge, large amounts of revenue could be lost by the companies and there could be potential litigation for compensation from victims. This led the tobacco industry to misrepresent and suppress the scientific evidence. The tobacco industry misrepresented information about lung cancer. For example, in the 1950s, a group of tobacco companies such as Phillip Morris, Brown and Williamson stated that ‘there is no conclusive scientific proof of a link between smoking and cancer. Medical research points to many possible causes of cancer’. This was published in hundreds of newspapers across America. There was a deliberate conspiracy between tobacco companies to misrepresent the data.
In addition, scientific evidence was supressed. For example, the research division for the RJ Reynolds tobacco company was shut down in 1970 by the company’s legal department in order to prevent further research when it appeared that there may be a link between smoking and lung cancer.]

Let's see the sample answer that it comes from the marking criteria. So the first one again, explain the topic and what are the interest behind the tobacco industry to avoid that link to lung cancer. And you can see in here, the research, this led the tobacco industry to misrepresent and suppress the scientific evidence. So they are going to misrepresent. So, they are going to manipulate that research and they are going to suppress, subdue, some research in their own benefit. So it put an example in here with the companies, the tobacco companies and what they did. And they said, there is no conclusive scientific proof of a link between smoking and cancer. So that is misrepresenting data and suppressing data. And then what happened with that information? It was published in across hundreds of newspapers, and it was a deliberate conspiracy to misrepresent data.

Okay, second example, in addition, scientific evidence was suppressed. The research division for Reynolds Tobacco Company was shut down by the company's legal department in order to prevent further research. When actually they demonstrated that there was a link between smoking and lung cancer. So, with this question, I'm going to finish my presentation in here. And then hopefully this presentation help you to understand a little bit, what are the requirements. Obviously, I can talk for hours, about every single skill, but if you need help or you have questions about it, or you want to discuss a specific section, please contact us in the Science Statewide staffroom, we are really happy to help. We are really happy to answer more questions. We are really happy to send you information about our resources.

So these are the acknowledgements of the ones that we were using for this presentation. And I hope that this presentation was actually helpful and we are going to see you around, in our meetings, in the Statewide room in teams. See you then. Bye, bye, stay in touch.

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