

Areas of knowledge worksheet – model

Question	Element of the knowledge framework	Area of knowledge
1	<p><i>Scope A: Aim of the endeavour</i></p> <p>What is the aim of this area of knowledge?</p> <p>What do practitioners want to know?</p> <p>What does the practitioner of this area of knowledge aim to explain, describe, discover, develop or create?</p> <p><i>Hint: This is a question about intent!</i></p>	<p>History</p> <p>Historians want to know what happened in the past. (IB stipulates that an event must be more than 10 years old in order to qualify as history.) When we think of history, we generally mean the history of humankind, which means the history of humans' actions. Historians also want to know why people behaved as they did, how past events are related causally to each other and how that past has led to the present.</p> <p>All of the areas of knowledge and the topics of the optional themes also have a history: we can investigate the history of politics, say, or the history of language or the history of the natural sciences or art.</p>
2	<p><i>Scope B: Nature of facts</i></p> <p>What is the material with which the practitioners of this area of knowledge must work in order to achieve their aims?</p> <p>How does the aim of the area of knowledge determine what materials are relevant?</p> <p>This is a question about the stuff that the practitioner actually studies, including physical objects, data or ideas – anything from which the practitioner divines new knowledge.</p>	<p>History</p> <p>Historians work with the artefacts which remain from historical events. These can include a huge variety of objects, such as ancient paintings in caves, pottery, ruins of buildings, documents, photographs and recorded interviews with eyewitnesses to historical events. In more recent times, tweets and other posts on social media have become artefacts with evidence of people's engagement with events. As time has gone on, humans have developed more and more ways to record events and people's reactions to and feelings about them, so that the more recent the historical event, the more likely there is to be a vast collection (and array) of artefacts to study.</p> <p>Primary sources are the actual artefacts; secondary sources are works that historians have created and in which they have expressed their ideas about what happened in the past and why. Secondary sources are also used by historians as they try to make knowledge in their area.</p>
3	<p><i>Scope C: Importance of the subject to the world</i></p> <p>What is the impact of this area of endeavour to the world?</p> <p>Why is it valuable?</p>	<p>Mathematics</p> <p>One reason that mathematics is important to the world is that it describes the physical world in terms that allow us to apply it to problem solving in science in particular, but also in politics, economics and many other areas where statistical analysis can be used. Mathematics provided the models, for example, that allowed humans to send spaceships into outer space – and to the Moon – and bring them safely back again. Mathematics provides the models which allow us to build skyscrapers, bridges and computers. Mathematics has famously altered the way that sports are played. The statistical analysis of events in thousands of baseball games, for example, can help managers to choose players wisely, as well as to plan a game strategy depending on the opponents they are facing.</p> <p>Individuals use mathematics for everyday problem solving in such activities as budgeting, planning for a financial future and figuring out how to scale a recipe up or down.</p> <p>Mathematics is important, in other words, because it helps us to predict and control the world around us.</p>

4	<p>Perspectives A</p> <p>Do people from different cultures understand this topic or develop knowledge in this topic in significantly different ways?</p>	<p>Mathematics</p> <p>In terms of content, there are not different perspectives in developed mathematics. What has been proven is, by definition, the same for everyone who uses the maths, regardless of culture or geography.</p> <p>In terms of making mathematical knowledge, however, there can be differing perspectives on what the best way is to answer questions and develop proofs. Conjectures about how certain mathematical processes work can be different when mathematicians come at the problems from differing backgrounds.</p> <p>One important difference in perspective which has yet to be resolved is the question of whether mathematics is an invention of humankind, or whether it exists out there in the universe, in some way similar to the way stars or trees exist, because it was created by God or a god or some gods. If this is the case, then we discover mathematics, rather than invent it.</p>
5	<p>Perspectives B</p> <p>What does understanding this subject from different perspectives add to our understanding of the subject as a whole?</p>	<p>The Arts</p> <p>Differing perspectives are essential in the arts. Every artist's work provides us with a different perspective on the world, and different artworks treating the same subject provide us with different perspectives on that subject. Being able to engage with different perspectives is, therefore, a fundamental part of an audience's ability to make knowledge in the arts. Understanding a subject through multiple perspectives in multiple works of art expands our understanding of our common humanity.</p> <p>Another important advantage to approaching the arts from different perspectives is that when we discuss a work of art with others, we find that they notice aspects of it, or interpret aspects of it, differently from the way that we do, and this inevitably expands our understanding of the individual work of art.</p>
6	<p>Methods and tools A</p> <p>Is the knowledge in this area of knowledge created by practitioners or discovered by practitioners?</p> <p><i>Hint: The answer is unlikely to be one or the other; aspects of both are present in all areas of knowledge.</i></p>	<p>The Arts</p> <p>On the surface, artists create the knowledge because they create the work of art, and audiences discover the knowledge which is in the art to be discovered; however, the dynamic among artist and audience and artwork is more complicated than that. The audience attempts to discover what the artist intended, but since this act of 'communication' is indirect – through the artwork – the audience can never be certain what was intended. Engaging with a work of art is a creative act: we have to interpret meaning by observing details closely and imagining what those details signify. Additionally, what the audience brings to the engagement with the work of art shapes what it is possible to get from that artwork. The audience for a given work may know something the artist didn't know, which means that the receivers of that art can interpret something which was not in the artist's mind, because they can imagine things that the artist could not imagine. The opposite is, of course, also true: the artist can know things that the audience does not know, which means that the artist could have meant something which is not accessible to the audience, especially over boundaries of space and time.</p>
7	<p>Methods and tools B</p> <p>How does the fact that the area of knowledge is created and/or discovered (as you identified in your answer to question 6) reflect a) the aim of the area of knowledge and b) the nature of the materials available for study?</p>	<p>The Arts</p> <p>a Art is highly personal. An important aim of the arts is the communication of an idiosyncratic worldview from the artist to the audience. This means that the artist must create the art which can convey the ideas or feelings about human experience, and the audience must discover what was intended.</p> <p>b The nature of the materials under study means that for the audience, the act of understanding what the artist intended is an indirect act, which accounts for the creative work required by the receiver of the art, as well as for the discovery of what is there. For the artist, the materials under study include everything in human experience. The artists observe that world and then create a way to express what they observe.</p>

8	<p><i>Methods and tools C: What do practitioners do?</i></p> <p>How do we generate (create, discover, develop) knowledge in this area? (Make equations, do proofs, experiment? What is the work that practitioners undertake?)</p> <p>Describe the processes in detail. If the activities are very disparate, depending on the particular niche a practitioner works in, then give a general overview and use one specific example to illustrate.</p>	<p>The Natural Sciences</p> <p>The natural sciences rely on the scientific method as the primary means of making knowledge. The scientific method is not really one specific thing; it is instead a framework with features intended to ensure that knowledge is accurate and unbiased. In experimental science, the scientific method begins with careful observation of some aspect of the natural world, followed by hypothesizing about some very specific aspect of the observation in context with what is already known. Scientists then develop a test of the hypothesis – the experiment. The hypothesis and experiment must be very carefully tailored so that only one thing is being tested at any given time. If there are too many variables, then no one will be able to say with any degree of certainty that the results were caused by one thing in particular. Scientists then run the experiment and observe closely again; this time, the observation is of what happens during the experiment. These observations (the data) must then be carefully analysed in terms of what they suggest with regard to the hypothesis. Findings must then be reported to the scientific community, and the results peer reviewed and replicated before they are widely accepted as knowledge.</p> <p>At any point in the process, new ideas and observations can cause a change in direction. New hypotheses can be formed, or it can become clear that the experiment is flawed, in which case it will be abandoned. The data can be confounding, in which case the experiment will be repeated or modified. Peer review or efforts to replicate the experiment may turn up flaws in the reasoning behind the analysis, errors in the construction or running of the experiment, or bias, leading to the exclusion of some data. Any of these will cause the work to be approached again, probably from the beginning. When there is high confidence in the findings, many new questions will arise to provide fertile territory for new work.</p> <p>Some scientists, such as those studying earthquakes or supernovas, cannot design and implement experimental efforts to answer questions. They must rely on gaining access to repeated events, observing closely and trying to explain phenomena based on how what they see coheres with what they already know. They must be extremely careful to attend to the different conditions present at each new occurrence. The same processes apply, however, for careful observation, rational analysis and peer review. Regardless of the approach, the object is always the unbiased description of reality.</p>
9	<p><i>Methods and tools D: Underlying logic</i></p> <p>How do the methods described in question 7 on page 2 reflect a) the fact that they were developed in response to the boundaries established by the goals of the area of knowledge and b) the nature of the material with which practitioners must work?</p>	<p>The Natural Sciences</p> <p>a The primary objective of the natural sciences is to discover and describe actual facts about the physical features of the universe. The aim is to describe things as they are, and only those things which are actually there, undistorted as much as humanly possible by the individual scientist's powers of observation, wishes, desires and assumptions. These goals account for the aspects of the scientific method which require narrow focus, careful observation, re-testing and peer review. All of these elements are designed to eliminate human error, bias and ambiguity.</p> <p>b The material under study is the physical universe, which means that all the objects are physical objects. Since the objects are physical, and they exist now, they can be observed now; hence, observation is the core method for the natural sciences. Even in cases in which the scientists seem to be studying the past, such as the Big Bang, or historical artefacts such as pottery or middens at archaeological sites, they are studying things that exist today. Ancient light particles reach us now after billions of years of travel through space. The garbage middens have remnants in them – bones, pottery shards and so on – which can be subjected to techniques such as carbon dating.</p>

10	<p><i>Methods and tools E: Problems</i></p> <p>In what ways can the knowledge generation process go wrong? Explain the problems that arise from:</p> <ul style="list-style-type: none"> a the aims of the area of knowledge b the materials available c the methods available d human cognition. 	<p>The Human Sciences</p> <p>Human scientists wish to understand the nature of human beings in terms of their motivations, emotions, values, beliefs and other mental processes. They are interested in the physical aspects of the person insofar as it influences the mental and emotional aspects of a person's behaviour. Various problems are inherent in this endeavour:</p> <ul style="list-style-type: none"> a The aims are problematic, because human behaviour is not like the processes of nature. Human behaviour is subject to human choice, which may not be consistent. b The materials under study are humans themselves, along with evidence they have left of their behaviour. As just noted, humans are not necessarily consistent, so it is never going to be possible to develop laws in the way that scientific laws can be made for biology or physics, and proofs, such as those in maths, are also not possible. c The main methods in the human sciences are observation of humans and interviews with humans. Observing humans can be problematic, because if they know they are being observed, they may behave differently than if they are not, but observing humans without their knowledge brings up all kinds of ethical questions, such as the protection of people's privacy. Interviewing humans can be problematic because, as with observation, since those humans know they are being included in a scientific project, they may wish to present a false front, if they feel that their real ideas, feelings or behaviours are in some way not appropriate or otherwise insufficient. d The various personal cognitive tools – reason, emotion, intuition, imagination and so on – are always problematic, and that is no different in the pursuit of knowledge in the human sciences. We can fail to observe well, misunderstand what we are seeing, reason badly or fail to imagine effectively. These problems are exacerbated in the human sciences as we are trying to make knowledge about targets which do not stand still.
11	<p><i>Methods and tools F: Solving problems</i></p> <p>Explain how the established methods and accepted protocols for this area of knowledge have been designed and/or adapted, in order to minimize the problems you identified in question 10.</p>	<p>The Human Sciences</p> <p>Two significant ways that human scientists endeavour to minimize the problems of making knowledge in the human sciences are through repetition and through the observation of large numbers of subjects. Mathematics can help human scientists determine how many people are needed for a given study in order for the results to be statistically significant. Replication increases the number of people who have been studied and can strengthen confidence in the finding.</p> <p>A third important protocol is that in the human sciences, the results themselves are not presented as laws, but rather as probabilities, often expressed in percentages. For example, many studies have shown that children of divorced parents are themselves more likely to divorce than children whose parents did not divorce. This phenomenon is called the 'intergenerational transmission of divorce' (Dennison). That finding does not apply to every child of parents who divorced, nor does it mean that no children whose parents did not divorce will get divorced themselves. It describes a pattern which is statistically significant.</p> <p>As natural scientists must do, human scientists must be careful about how they phrase their findings by describing carefully the conditions under which those findings apply. Perhaps findings in the UK do not match findings when the same study is run in China or Brazil or the Philippines. If they do not, then effort must be made to explain the differences, since biologically speaking, humans in all those countries are the same.</p>

12	<p>Ethics A</p> <p>What ethical constraints are there related to the study of this subject and the dissemination or use of the knowledge generated in this area?</p>	<p>The Human Sciences</p> <p>Because the experimental subjects in many human scientists are living humans, strict ethical rules apply. There are lots of experiments which cannot be run because they run the risk of causing the subjects to suffer physically or psychologically. Some experiments have been run in the past that were afterward banned from being repeated because it was discovered, through the running of the study, that it caused damage to the subjects.</p> <p>Another important ethical constraint on human scientists is that they must take care in the design of their studies not to lead the subjects to behave in such a way as to deliver the result that the scientist wants. An example of this is that it can be very difficult to write survey questions which are not leading or emotionally loaded, pushing respondents to provide a particular answer.</p>
13	<p>Ethics B</p> <p>What does the knowledge of this subject contribute to our understanding of what constitutes ethical actions?</p>	<p>Religion</p> <p>Religions are among the primary sources of knowledge about what it means to behave in an ethical fashion. Holy texts contain specific rules for the right way to behave, and religious leaders are also leaders in moral and ethical education. Although stated moral principles differ from religion to religion in some ways, there is one rule which has been found in every known religion, in one form or another: 'Do unto others as you would have them do unto you.'</p>
14	<p>Connection to the core theme A</p> <p>What is the role of an individual practitioner in contributing to the knowledge developed in this area of knowledge?</p> <p>Are there certain kinds of people who are more successful?</p> <p>Who is able to make greater contributions? Why or why not?</p> <p>Give one example of a specific practitioner in this area of knowledge and explain how their personal knowledge contributed to the shared knowledge within the formal discipline. If you think there was something particular about this person which made them better suited to develop the knowledge in question, explain why.</p>	<p>The Natural Sciences</p> <p>In 2006, Dr Jerry Powell, professor emeritus at the University of California, Berkeley, discovered a moth at the light trap on his porch which had never before been seen in North America. Powell was singularly qualified to recognize the moth, <i>Epiphyas postvittana</i>, or Light Brown Apple Moth, because he had worked in its native Australia 20 years before. The moth is a highly destructive agricultural pest, and Powell's discovery led to a massive project to eradicate the moth in an effort to protect the multi-billion dollar agriculture industry in California (Stannard).</p> <p>The fact that Powell had the background knowledge necessary to recognize the moth was critical to the relatively early warning to the agriculture industry. He also clearly had a prodigious memory, since he could still recognize the moth and correctly identify it 20 years after he encountered it in Australia. His long career in entomology in the area also meant that he knew what the implications of the find were and who to contact about it. This is an excellent example of how the personal knowledge and abilities of a scientist can influence the knowledge that it is possible to make – and the speed with which it can be made.</p>

<p>15</p>	<p><i>Connection to the core theme B</i></p> <p>How does the nature of the area of knowledge (the aims and the material) determine the use of the ways of knowing? You may need to connect your answer to the methodology (and technology) employed in this area of knowledge.</p> <p>Are some of the ways of knowing more useful or more valued? Why or why not?</p> <p><i>Note: You need to consider a wide variety of ways of knowing – they do not operate in isolation, nor is any one area of knowledge dependent on just one or two! You do NOT have to address emotion as a source of motivation; that is true for every area of knowledge (and indeed for any endeavour in life), so it is not interesting as a means of defining the specific nature of any one AOK.</i></p>	<p>Indigenous societies</p> <p>Indigenous people seek to know the same kinds of things that everyone seeks to know. What distinguishes indigenous knowledge is very often the methods that are used to achieve the aims that Indigenous people have. Some examples: the Indigenous people of the Pacific northwest have amassed deep knowledge of the plant and animal life around them, including the creatures of the sea. They know which things are edible and when to find them, and they know how many can be taken without destroying the population ('Northwest Coastal People'). The Indigenous people of Polynesia knew how to navigate the oceans without any modern technology – knowledge which has been redeveloped in recent years (Davis). The primary methods for gaining this knowledge are very careful observation using all the senses rather than relying primarily on sight, as well as highly advanced memory. The Polynesian wayfarers additionally, and simultaneously, use imagination to be able to hold in their minds a picture of where they are at any given time, relative to where they have been and where they are going. The wayfinding and the gathering of food both require speech, as the knowledge is passed down by word of mouth from generation to generation.</p>
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