Guidelines For Making

Multiple Choice Questions

Co-created by **CBSE - Centre for Excellence in Assessment** and **Educational Initiatives**

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Executive Summary

Well-designed questions are central to the creation of good assessments. Through such questions, students' analytical abilities and higher-order thinking skills are tested. Multiple- choice questions (MCQs), especially, are an effective way to measure students' understanding of crucial concepts, judgement and problem solving skills. Such questions also provide nuanced data on student learning outcomes and misconceptions.

To create well-designed questions that can enable the above, educators should abide by the following key principles for assessment creation:

1. *Test understanding of concepts and not just recall of facts*
2. *Test core learning and not peripheral facts*
3. *Use unfamiliar contexts to identify real learning*
4. *Test what is intended to be tested*
5. *Frame the question in an unambiguous and technically correct way*
6. *Test specific alternate conceptions, misconceptions and student errors*
7. *Use real-life, authentic contexts instead of contrived ones*
8. *Use stimulus materials as needed and test higher-order skills*
9. *Use authentic data, maps, graphs or any other information*
10. *Use age-appropriate content, contexts as well as language*

It is important to bear in mind, however, that MCQs may not always be able to test higher-order thinking skills in-depth or assess a student's ability to organise and present knowledge. Therefore, it is crucial that examiners first determine what they aim to test and then choose a mode of testing.

Further, despite their apparent simplicity, formulating choice-based questions call for deep pedagogical expertise. For instance, formulating distractors (incorrect answers) - seeking to capture misconceptions preventing learning - requires regular engagement with the developments in education research. MCQs, if designed well, can diagnose learning levels and misconceptions at different cognitive levels. They can cover a broader range of content than essay-type questions and can also be graded easily. They also have the potential to fairly assess students with writing related disabilities.

This guidebook illustrates, through a broad range of examples, how examiners can develop effective multiple-choice questions that test important concepts and encourage learning with understanding.

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"The one real goal of education is to leave a person asking questions."

- Max Beerhohm

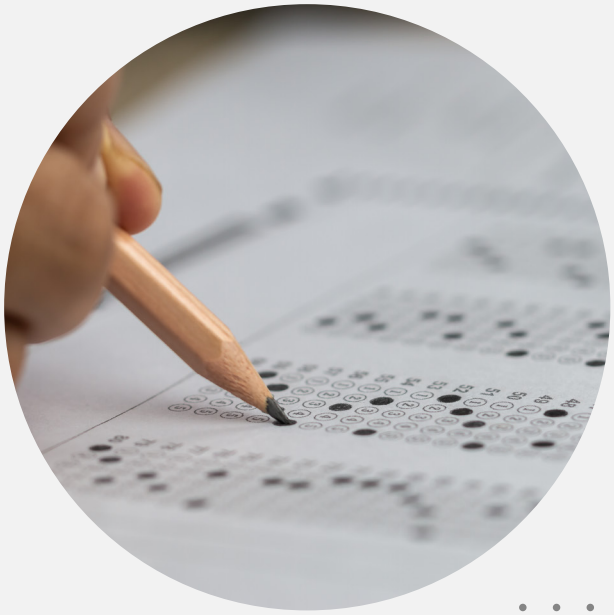
Role of Good Questions in an Assessment

Good questions are central to any good assessment and the quality of the questions determines the quality of the insights that one can derive based on the data on those questions. A good question is one that challenges and stimulates a learner to think deeply and apply concepts. The ability to ask questions that make students think both at the time of instruction and assessment is the hallmark of a good teacher. A good question, correctly framed, can help a teacher understand how a student thinks and how well a student has internalized a concept or mastered a skill.

Questions are important because of the following reasons:

- Good questions can influence how students learn and stimulate thinking
- Good questions can distinguish mechanical learning from learning with understanding
- Good questions can diagnose misconceptions and common errors

Tests are an important tool to help gauge how much has been learnt and how well children are doing. They are yardsticks that also provide valuable feedback about the effectiveness of instructional methods. Assessment with good questions should serve a dual purpose of measuring what students have actually understood as well as providing actionable insights. If we are able to empower teachers with the data they need to take the necessary action in order to overcome the gaps in learning, we should be able to see a positive shift in learning levels.



Making Multiple Choice Questions

A traditional Multiple Choice Question is one in which a student chooses one answer from a number of choices supplied. A multiple choice question consists of a:

STEM

the text of the question (with/without images, tables, graphs etc.)

OPTIONS

the choices provided after the stem (these include the key and the distractors)

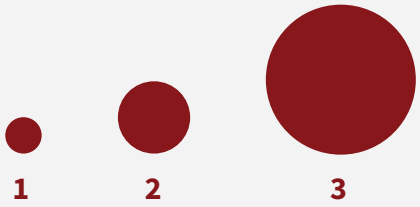
THE KEY

the correct answer in the list of options

DISTRACTORS

the incorrect answers in the list of options

Roma has 3 solid balls, all of equal weight. The sizes of the three balls are as shown below.



If ball 2 sinks in water, which of the other balls will DEFINITELY sink in water?

STEM

A Only ball 1 — KEY

B Only ball 3 — DISTRACTOR

C Both ball 1 and ball 3 — DISTRACTOR

D Cannot be sure — DISTRACTOR

OPTIONS

The stem is the beginning part of the question that presents the question to be solved, a question asked of the respondent, or an incomplete statement to be completed, and contains any other relevant information. Depending on the testing objective, it may even include an image or a graph or a table or any other source of information.

The options are the possible answers that the respondent can choose from, with the correct answer called the key and the incorrect answers called distractors. The options can be in any form – text or image(s).

For certain questions, such as application questions, the stem can consist of multiple parts. The stem can include authentic material such as a graph, a table, or a detailed description which has multiple elements to it. In such cases, the stem ends with a lead-in part explaining what the respondent is expected to do.

Key Principles of Question Creation

This section highlights some of the key principles of question creation, and while the examples used are primarily Multiple Choice Questions (MCQs), these fundamental principles apply to all questions. We have used examples to illustrate our points and clarify how to identify good questions from average or poor ones.

1 Test understanding of concepts and not just recall of facts

While a certain kind of recollection of knowledge is important and there should be questions testing that, it is also important to balance this with a substantial number of questions that test understanding of concepts and the application of those concepts in unfamiliar contexts. Evaluating students' conceptual understanding is useful as it can pinpoint areas that need further action in order to develop the concept or build future concepts. For example, there can be a question asking: What is the angle of earth's axial tilt? However, a question like the one illustrated below checks whether students can demonstrate the understanding of the concepts such as the tilt of Earth's axis in the given context.

***Sample question 1**: Question testing understanding of a concept*

The time and date in India in the picture shown is likely to be close to:

A 6 AM, November 10th

B 6 PM, November 10th

C 6 AM, May 10th

D 6 PM, May 10th

The question requires students to use the knowledge of the fact that the Sun rises in the East and so the eastern side of a country sees the light before the western side of the country. It also requires students to have understood that the Earth's tilt is different in different months, and for India, the tilt is away from the Sun during November. They need to use this understanding in the given context to determine the time and date when the picture may have been taken.

2 Test core learning and not peripheral facts

The question should test an important concept and not a trivial fact. While trivial facts should be avoided in any assessment, prioritisation of key ideas becomes important in a summative assessment as there is a limit to the number of questions that can be asked in a fixed time. Key ideas to be included in an assessment should be wisely selected to gather maximum information about students' learning levels and their understanding of concepts.
Here are examples of two questions, one testing recollection of a trivial fact and one testing recollection of an important fact. Questions like the first one should be completely avoided in an assessment.

Sample question 2 : *Recall of a trivial fact*

Where was Minamata disease first seen?

A India | B Japan | C USA | D South Korea

Sample question 3 *: Recall of an important fact*

For certain diseases caused by bacteria, certain antibiotics are prescribed. Antibiotics are medicines that

A Promote the growth of antibodies inside the body

B Cover the body cells so that bacteria cannot attack them

C Kill the desired bacteria but not the body cells

D Kill all the microorganisms inside the body but not the body cells

While sample questions 2 and 3 test the skill of recollection of knowledge, the outcomes of both are different. Question 2, for instance, tests the recall of a trivial fact that does not have any implication on conceptual understanding or a student's ability to learn other concepts. However question 3 tests the ability to recall of an important aspect of what an antibiotic does. Also, the way the distractors are framed in sample question 3 can help in understanding specific wrong notions students may have about antibiotics.

3 Use unfamiliar contexts to identify real learning

In order to prevent students from answering questions based on a question pattern or style that matches the ones from the textbook or past papers, it is important to ask the question in a way that makes them think deeply before they answer. So, while the concepts may be from the curriculum, the contexts used, or the framing of the questions should not be something that they are familiar with. This will help in differentiating between apparent learning and real learning.

***Sample question 4** : Textbookish question*

The gravitational pull on the Moon is _____ of that of Earth.

A 1/2 B 1/3 C 1/4 D 1/6

***Sample question 5** : Question with an unfamiliar context*

If you're standing on the moon holding a pen, and you let it go, it will _____

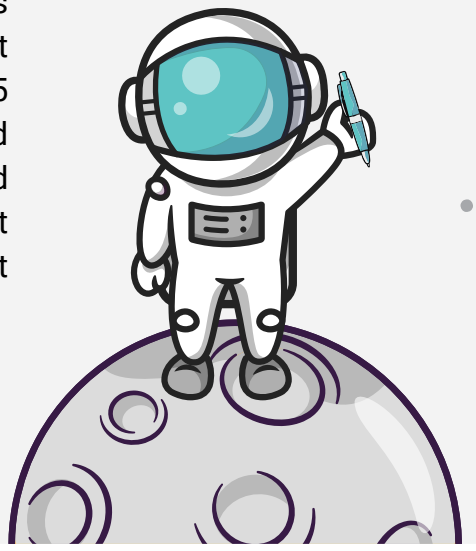
A Float away

B Float where it is

C Fall to the ground

D Float towards the Earth

Most textbooks mention the fact that the Moon's gravity is 1/6 that of the Earth's, a fact that is also emphasised by teachers and during certain exercises. So, when a question like sample question 4 is asked, students tend to instantly choose the correct answer. But does this indicate that students understand the tested fact - that the Moon also has gravity and, thus, if something is dropped on the Moon, it would fall to the ground? A question like sample question 5 can help in uncovering whether students have understood the concept or not. Also, the thoughtfully designed distractors, based on alternate student conceptions about gravity in space, can help in capturing specific incorrect notions.



4 Test what is intended to be tested

The question should have a clear testing objective and should test what it intends to test. This is a very important criterion to keep in mind while framing a good MCQ as it will determine not only the way the stem is framed, but also how the distractors are designed. The desired objective should be assessed without interference from other objectives. It reflects the content validity of the question.

***Sample question 6**: Question involving multiple concepts instead of the intended one*

Hema cut a ribbon of length 0.1 m into 10 equal pieces. How long will each piece be?

A 1 m B 1 cm C 10 m D 10 cm

***Sample question 7**: Question testing what is intended to test*

Hema cut a ribbon of length 0.1 m into 10 equal pieces. How long will each piece be?

A 0.001 m B 0.01 m C 0.1 m D 1 m

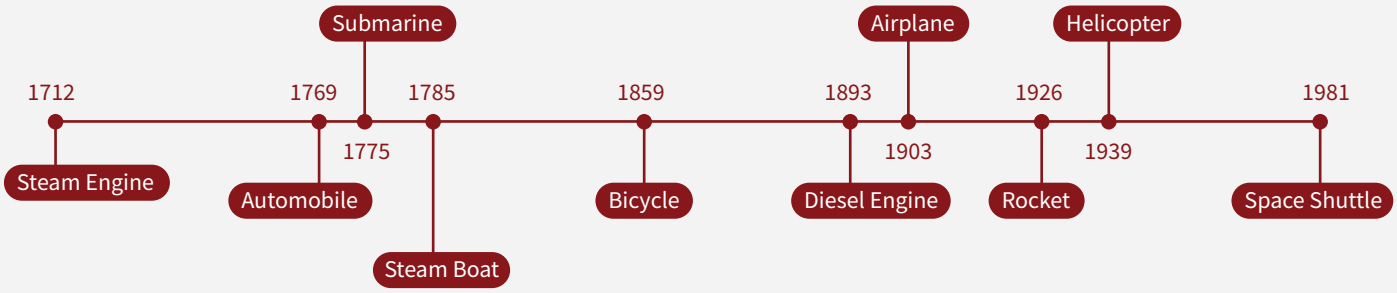
Let us assume the testing objective is to check whether students can divide a decimal by 10 or not. With sample question 6, in addition to the key idea of division of a decimal by 10, the conversion of metres to centimetres is also included. In contrast, sample question 7 assesses the key idea more effectively. In case the objective was also check for conversion of metres to centimetres, question 6 would be better suited.

5 Frame the question in an unambiguous and technically correct way

The question should have one clear answer and be unambiguous. This is one of the most important things to keep in mind while creating as well as reviewing questions. If the question is not clear or if there is no correct answer or multiple correct answers, it can be confusing for the students which is never the objective of a good question. Here are some examples of questions with no correct answer, ambiguous framing or technical errors.

***Sample question 8**: No correct answer*

The figure below gives the years of some important inventions in the field of transport.



Which of these inventions was made more than 70 years after the invention of the bicycle, but more than 50 years before the invention of the space shuttle?

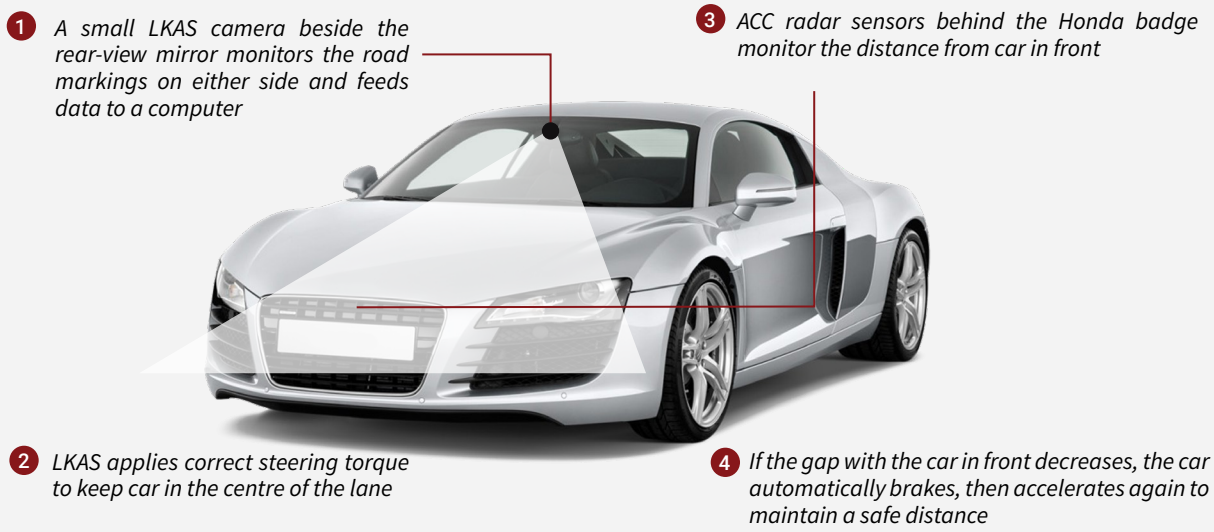
A Rocket | B Airplane | C Helicopter | D Diesel Engine

The question uses a good timeline chart and expects students to interpret it. The question asks for an invention that was made more than 70 years after the invention of the bicycle and more than 50 years before the invention of the space shuttle. More than 70 years after the invention of bicycle would mean after the year 1929 whereas more than 50 years before the invention of space shuttle would mean before 1931. There is no invention on the timeline for this period.

***Sample question 9**: Technically incorrect framing of the stem*

Extract from a passage:

Robotic cars are no longer a distant dream



Until now, cars that drive themselves have been the stuff of science-fiction movies. However, from March 2006 onwards drivers will be able to buy a car that does just that! Japanese car manufacturer Honda has developed a car that can drive itself on motorways.

A tiny camera by the rear-view mirror scans the white lines that mark out road lanes and help to keep the car inbetween them.

Source: 'Robotic Cars are no Longer a Distant Dream' http://www.thenewspaper.org.uk/science/pg000542.php

An advantage of the rear-view mirror developed by Honda is that it can help:

A. Steer the car within the prescribed lane

B. Cross bumps with little problem

C. Reproduce photographs of any road

D. Manoeuvre the car only without a driver

The question expects students to read the passage, comprehend the given information and answer the given question. The issue with the question is that the framing of the question is technically incorrect. It is the tiny camera which is by the rear-view mirror which is keeping the car in its lane and not the rear-view mirror itself. While students may even answer the question by identifying the closest possible answer, the question stands technically incorrect. Such errors cannot be allowed in questions.

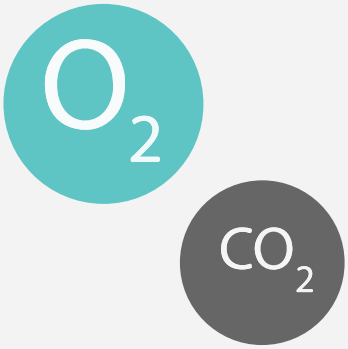
6 Test specific alternate conceptions, misconceptions and student errors

A list of alternate conceptions, misconceptions and common errors, built by looking at past data and international research, should be made available so that the distractors that are made are thoughtfully created and can help in capturing the misconceptions harboured by the students.

***Sample question 10**: Item testing alternate conceptions/misconceptions*

Which of the following are examples of respiration?

1. Humans use oxygen and release carbon dioxide.
2. Plants use carbon dioxide and release oxygen.
3. Burning dry leaves uses oxygen and releases carbon dioxide.



A Only 1
B Only 2
C Only 1 & 2
D All – 1, 2 and 3

The question tests whether students can identify examples of respiration. Students often have a misconception that like human use oxygen for respiration, plants use carbon dioxide for respiration. Option C tends to capture this misconception.

7 Use real-life, authentic contexts instead of contrived ones

The use of real-life contexts and data can make questions more engaging, and help students understand the practical importance of their education. Therefore, in addition to testing concepts, these questions become teaching tools in themselves. Their use in examinations will also encourage teachers to structure classroom instruction accordingly.

This principle can apply to questions across subjects. In Mathematics and Physics, for example, data and examples used in questions should be framed such that they relate to students' households, commutes, chores, etc. In language examinations, comprehension passages can be from real texts across domains such as history, science, or economics. While difficulty levels should be moderated based on grade levels, the principle should be followed as far as possible.

***Sample question 11**: Contrived use of a context*

5 g of camphor is taken on a tray and burnt. What is the weight of products obtained?

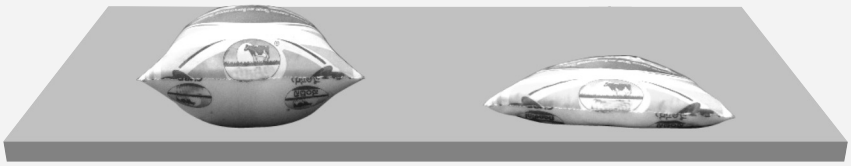
A 0 B 5 g C <5 g D >5 g

***Sample question 12**: Good real-life context*

Here are two images of the same packet of curds taken at an interval of 2 days. The packet had been left undisturbed at room temperature on the kitchen shelf. We don't know which photograph was taken first and which one was taken two days later.

Fig. A - packet of curd looking puffed and swollen

Fig. B - flat packet, full of curd



Which of the two packets will weigh more?

A The one in fig. A as it is larger in size

B The one in fig. B as its contents are denser

C The one in fig. A as the amount of curd in it increased

D There will be no difference in their weights

Sample questions 11 and 12 shown above test the concept of conservation of mass in an open/closed system. However, the context used in sample question 11 is a bit contrived. It doesn't specify how the products are obtained, how the gaseous products are weighed, whether it is in an open system or a closed one etc. It is unlikely that this one would encounter this experiment in real life. On the other hand, sample question 12 uses a simple yet popular context of a packet of curds puffing up and tests the concept of conservation of mass within a closed system. Since the packet was not opened, the microbes used the curds inside to grow and multiply and nothing would have entered or escaped the packet, the mass of the two packets will remain the same. The context used is authentic and it allows students to apply the concept in real life.

8 Use stimulus material as needed and test higher order skills

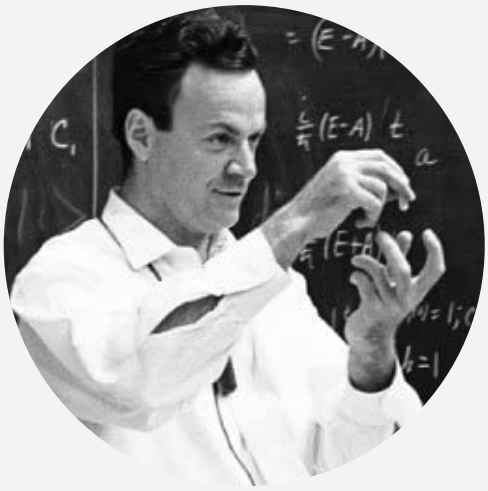
Many effective assessments make good use of stimulus material by using them as a passage or a piece of information and asking questions based on it. It can be a good way to present a real-life context to the student and check for application of a concept. What is more important in such cases is to ensure that the questions are linked to the stimulus material; students should not be able to answer the questions based on the material independently as that would defeat the purpose of using the material.

Also, one thing to note about MCQs is that while they can serve to test knowledge, understanding and application of concepts, they can also be used to test advanced understanding or other higher order skills, if designed well.

Here is a sample that illustrates how an excerpt from a book can be used as a stimulus material. It also shows a question based on it to indicate how an MCQ can be used to test higher-order thinking skills.

***Sample question 13**: Item using an authentic context*

The Amateur Scientist



At Alameda Street, some ants came out around the bathtub. I thought, "Here's a great oppurtunity to observe some of them." I put some sugar on the other end of the bathtub, and sat there the whole afternoon until an ant finally found the sugar. It's only a question of patience.

The moment the ant found the sugar, I picked up a coloured pencil that I had ready (I had previously done experiments indicating that the ants don't bother about pencil marks - they walk right over them - so I knew I wasn't disturbing anything), and behind where the ant went I drew a line so I could tell where his

When the next ant to find the sugar began to go back, I marked his trail with another colour. (By the way, he followed the first ant's return trail back, rather than his own incoming trail. My theory is that when an ant has found some food, he leaves a much stronger trail than when he's just wandering around.)

This second ant was in a great hurry and followed, pretty much, the original trail. But because he was going so fast he would go straight out, as if he were gliding, when the trail was wiggly. Often, as the ant was "gliding," he would find the trail again. Already it was evident that the second ant's return was slightly straighter. With successive ants the same "improvement" of the trail by hurriedly and carelessly "following" it occurred.

I followed eight or ten ants with my pencil until their trails became a neat line right along the bathtub. It's something like sketching: You draw a clumsy line at first; then you go over it a few times and it makes a nice line after a while.

Surely You're Joking, Mr. Feynman by Richard P. Feynman. Some text has been modified for readability.

Assuming that the theory he proposed was correct, what would have happened if the sugar was suddenly removed?

A The ants will still keep following the trails made by other ants

B Some ants will start wandering while others will follow the paths forever

C The ants will follow the trail for a little while and then start wandering again

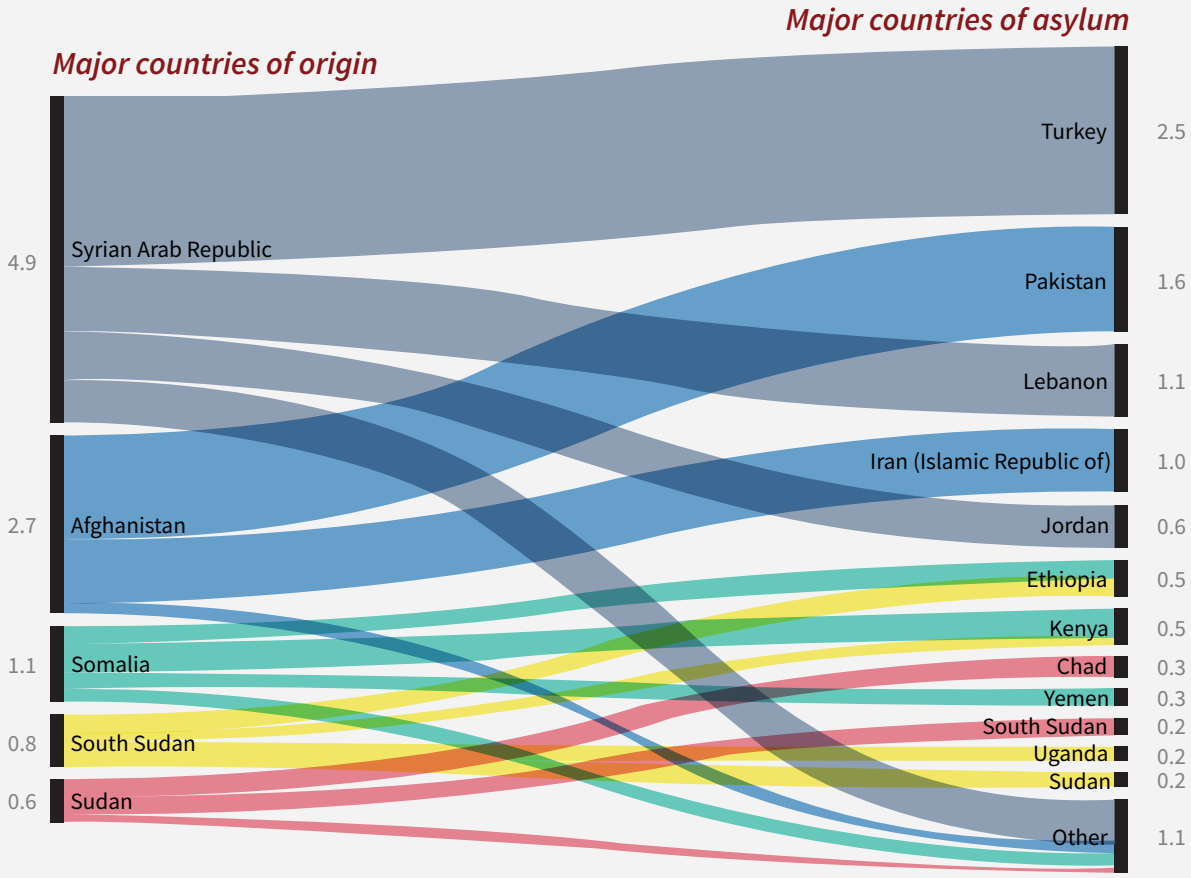
D The ants will start leaving even stronger trails in the absence of food

9 Use authentic data, maps, graphs or any other information

As far as possible, data, maps, graphs or other information used in items should be from an authentic source. This can allow students to relate to the context better and read about real-life applications of what they are learning.

***Sample question 14**: Item using data from an authentic report*

The UN reports that the number of refugees migrating as a result of conflict or insecurity has never been higher. This graph provides some information about this global crisis.



Note: Number of refugees in million

Based on this, the majority of the almost 10 million refugees found safety in _____

A Countries separated from them by sea

B Neighbouring countries

C European countries

D African countries

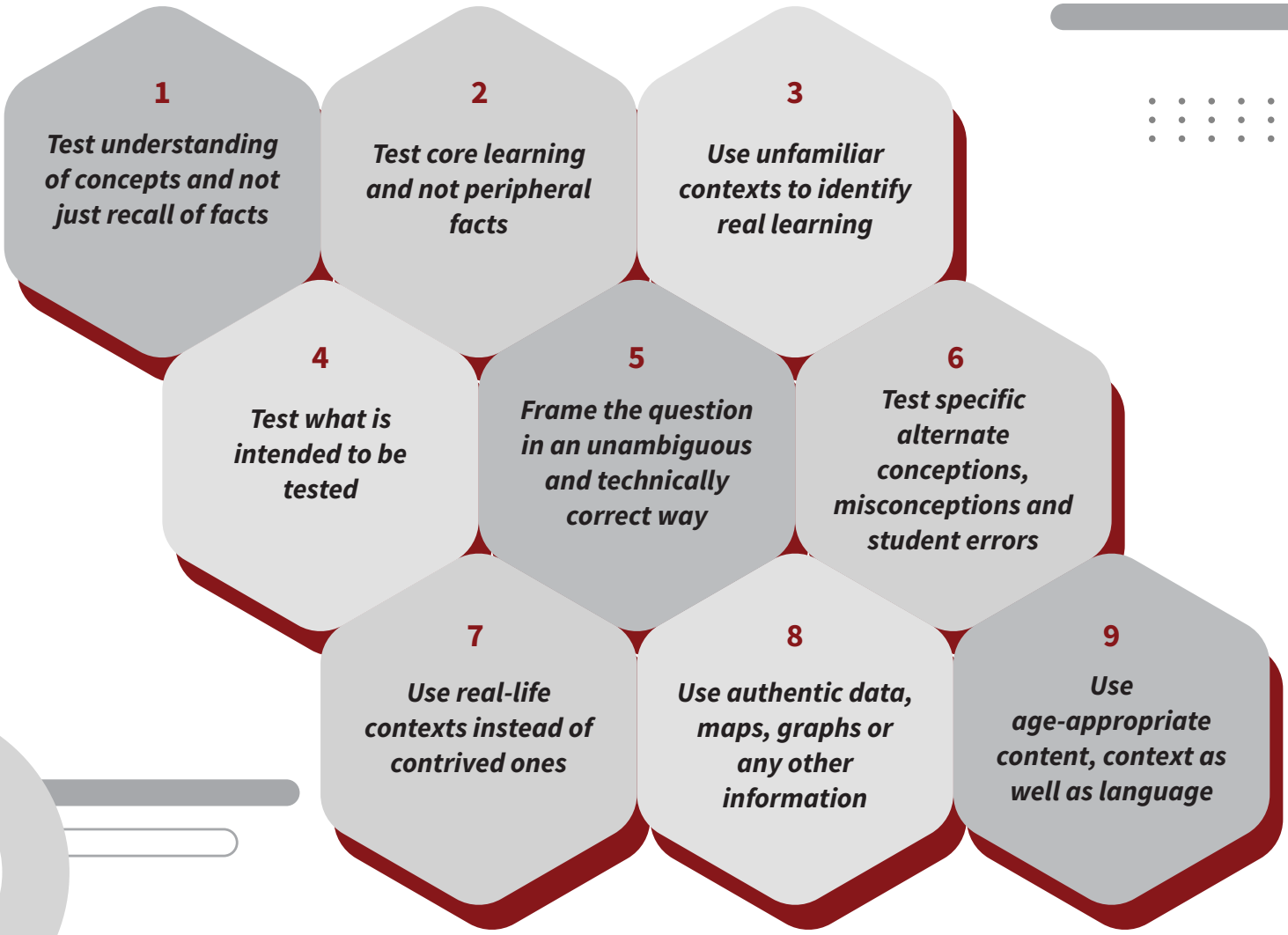
The question uses an infographic from an actual report and asks a question that expects students to apply their knowledge of countries and their geographical locations.

10 Use age-appropriate content, context as well as language

The question should be age-appropriate (in terms of content as well as language). This is another criterion which is important as it determines the validity of the question. If students cannot answer the question because of specific terms that they have not encountered or specific concepts that they are yet to learn/be exposed to, it affects students' performance, and the question doesn't help in revealing the learning level of the students.

Key Takeaways:

In summary, these are the main points to keep in mind when framing a good question. A good question should:



Using Multiple Choice Questions

Advantages of MCQs

- MCQs can be designed with a diagnostic end in mind, in order to find out whether specific areas of a given subject are adequately known, or in order to detect misconceptions. This can provide feedback on the effectiveness of instruction.
- MCQs can be scored quickly and reliably using computer systems (or even manually for small numbers) as compared to other question types. Also, the wrong answer choices can provide valuable information about how students are thinking. For example, a teacher can give a 5-10 question MCQ test on a topic to a class of 40 students, and use the data powerfully to gain insights about the understanding levels in her class.
- MCQs can be set at different cognitive levels. For example, a question may simply challenge a student's ability to recall facts, while another may test a student's ability to apply factual knowledge to given situations; or, at a higher level, a question may test a student's ability to evaluate given information.
- Tests made up of MCQs can provide better coverage of content than one with purely essay-type questions, thus broadening the scope of the test.
- MCQs provide an opportunity to assess the abilities of students with writing difficulties in a fair manner.

Disadvantages of MCQs

- It can be challenging to create higher-level questions testing skills related to application or appreciation.
- They cannot test the ability to organize and present knowledge.
- It can be time-consuming to construct a good question with good distractors (wrong answer choices). Pedagogical content knowledge, especially related to alternate conceptions and different errors students make is needed to make good distractors.

Constructing Multiple Choice Questions - Good Practices

Question stem

1. *When the stem is an incomplete statement, place the "blank" for the correct choice at the end of the statement.*
2. *When a negative question is used, emphasize the negative word or phrase; that is, underline, capitalize, or italicize, for example, "DOES NOT."*
3. *Avoid grammatical clues to the correct answer such as "a" or "an" as the last word of the stem or plural verbs that match plural choices.*
4. *Avoid any form of bias against any gender, religion, caste or community.*
5. *If all options begin with common words or phrases, then place these commonalities at the end of the stem.*
6. *Write the stem such that the students don't have to read all the options before they can determine the question.*
7. *Phrase stems as clearly as possible. Confusing questions can generate wrong answers from students who do understand the material.*
8. *Especially for classes lower than 6, do not use negatively-stated stems, as the resulting double-negative is confusing.*

Options

1. *Include at least four, but not more than five, possible responses.*
2. *Only one response should be correct.*
4. *If a hierarchy exists within the responses, place them in ascending order (e.g., numerical responses in numerical order wherever possible, years in chronological order, etc.).*
5. *Avoid language that is similar or identical to important words in the stem.*
6. *Make the distractors incorrect but plausible, preferably based on common errors that students make.*
7. *Provide reasonably plausible choices.*
8. *Avoid distractors that may seem obviously incorrect.*
9. *Avoid patterns in placing correct answers (such as having "C" correct in more than half of the questions).*
10. *Use "none of the above" and "all of the above" with appropriate discretion. They can give away the answer or cause confusion, if all alternative choices aren't worded very carefully.*
11. *Keep the option lengths the same and parallel in grammatical structure. Too much detail or a different grammatical structure can give the answer away.*

DOs and DON'T's to consider while making MCQs

DON'T

- Use superfluous information or images.
- Use unnecessary jargon or overly specific or technical knowledge.
- Make typos and grammatical errors as far as possible.
- Provide cues from one question to another; keep questions independent.
- Allow for grammatical inconsistency between stem and options.
- Use humour when developing options.
- Use full stops in options if the stem is in completion form.
- Use "none of the above" or "all of the above" in options unless necessary.
- Use terms such as "always" or "never" in options, as they generally signal incorrect choices.
- Use negative options following a negative stem.
- Use wording from the stem in the correct option.
- Provide irrelevant clues to the correct option in the stem.
- Turn a test of a subject matter into a test of reading comprehension.

Key Takeaways:

1. *Decide the learning outcome(s) to be tested by the question*
2. *Eliminate as many ambiguities as possible*
3. *Create distractors based firmly on what you want to test, keeping in mind the uniformity in their form and the length*
4. *Make sure that the wrong answers can be explained justifiably*
5. *Be prepared to give feedback for the correct answer, explaining why it's right*

Case Study Questions

Case-based questions typically use a stimulus material, which is often an authentic source of information, and expect students to apply the concepts they have learnt to answer questions based on the stimulus material. This is a common practice followed by many international examination boards and even international assessments like PISA.

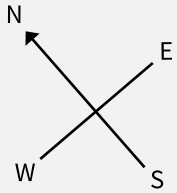
Here's a typical structure of Case Study questions. There is a Unit, which comprises of the Case or the stimulus material and a set of questions that are based on the case.

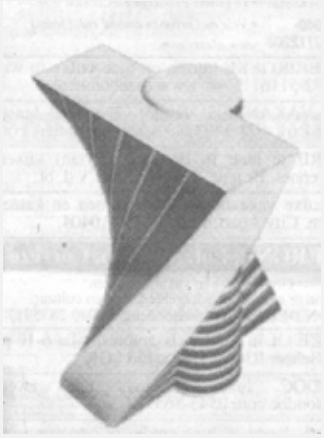
Unit

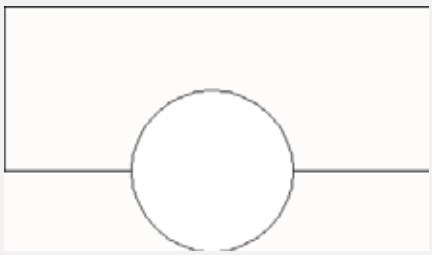
Twisted Building

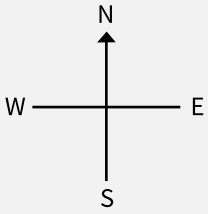
Stimulus

In modern architecture, buildings often have unusual shapes. The picture below shows a computer model of a 'twisted building' and a plan of the ground floor. The compass points show the orientation of the building.



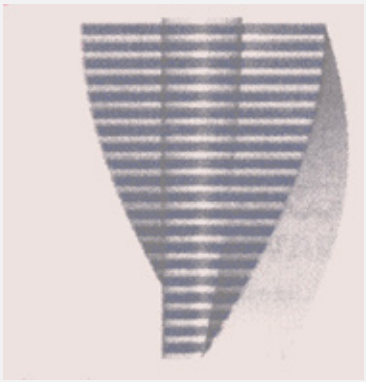


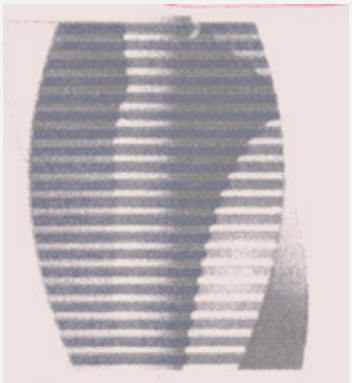




The ground floor of the building contains the main entrance and has room for shops. Above the ground floor there are 20 storeys containing apartments.
The plan of each storey is similar to the plan of the ground floor, but each has a slightly different orientation from the storey below. The cylinder contains the elevator shaft and a landing on each floor.

The following pictures are sideviews of the twisted building.





Question

Question 2: TWISTED BUILDING
From which direction has Sideview 1 been drawn?

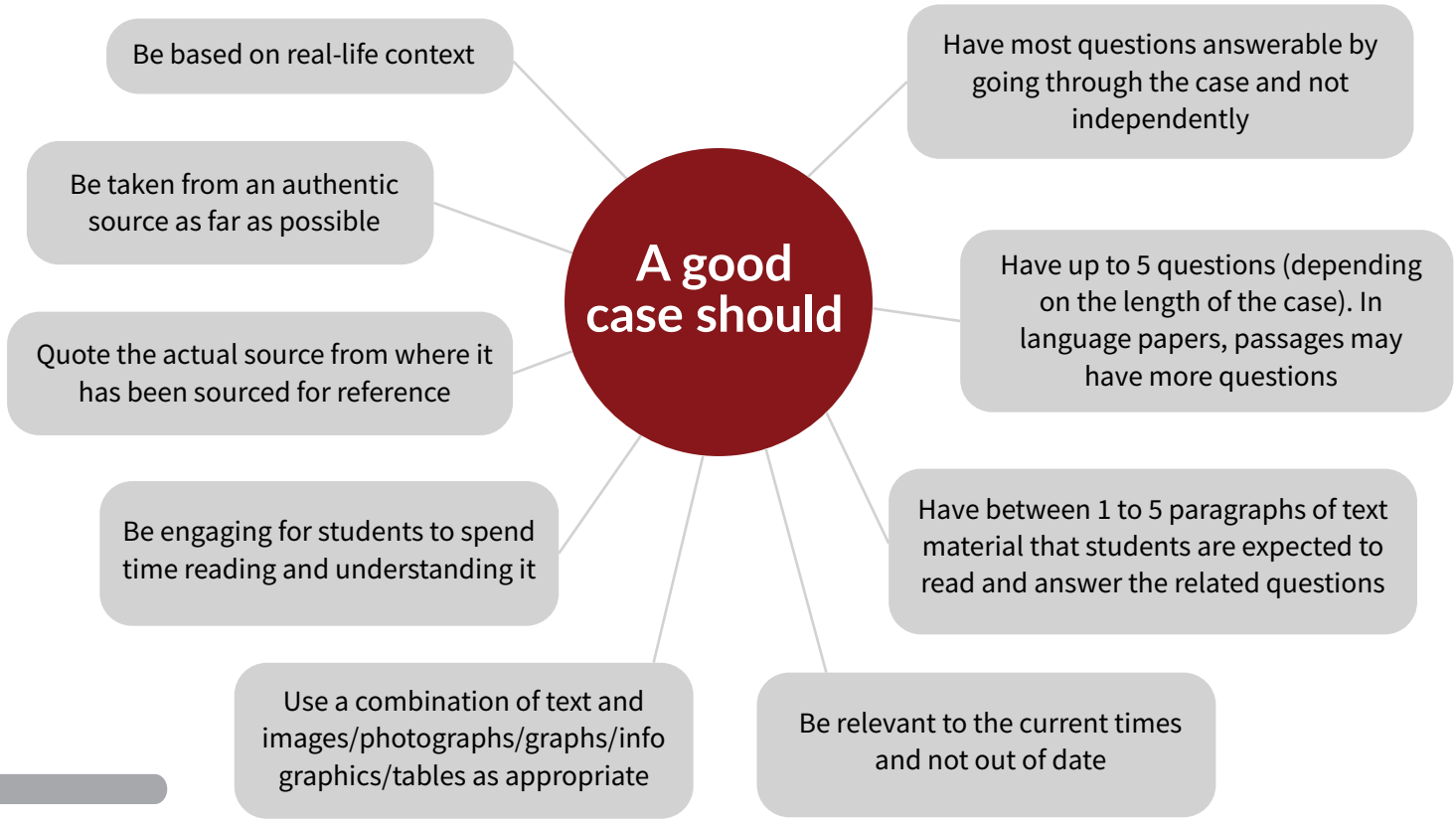
A From the North | B From the West | C From the East | D From the South

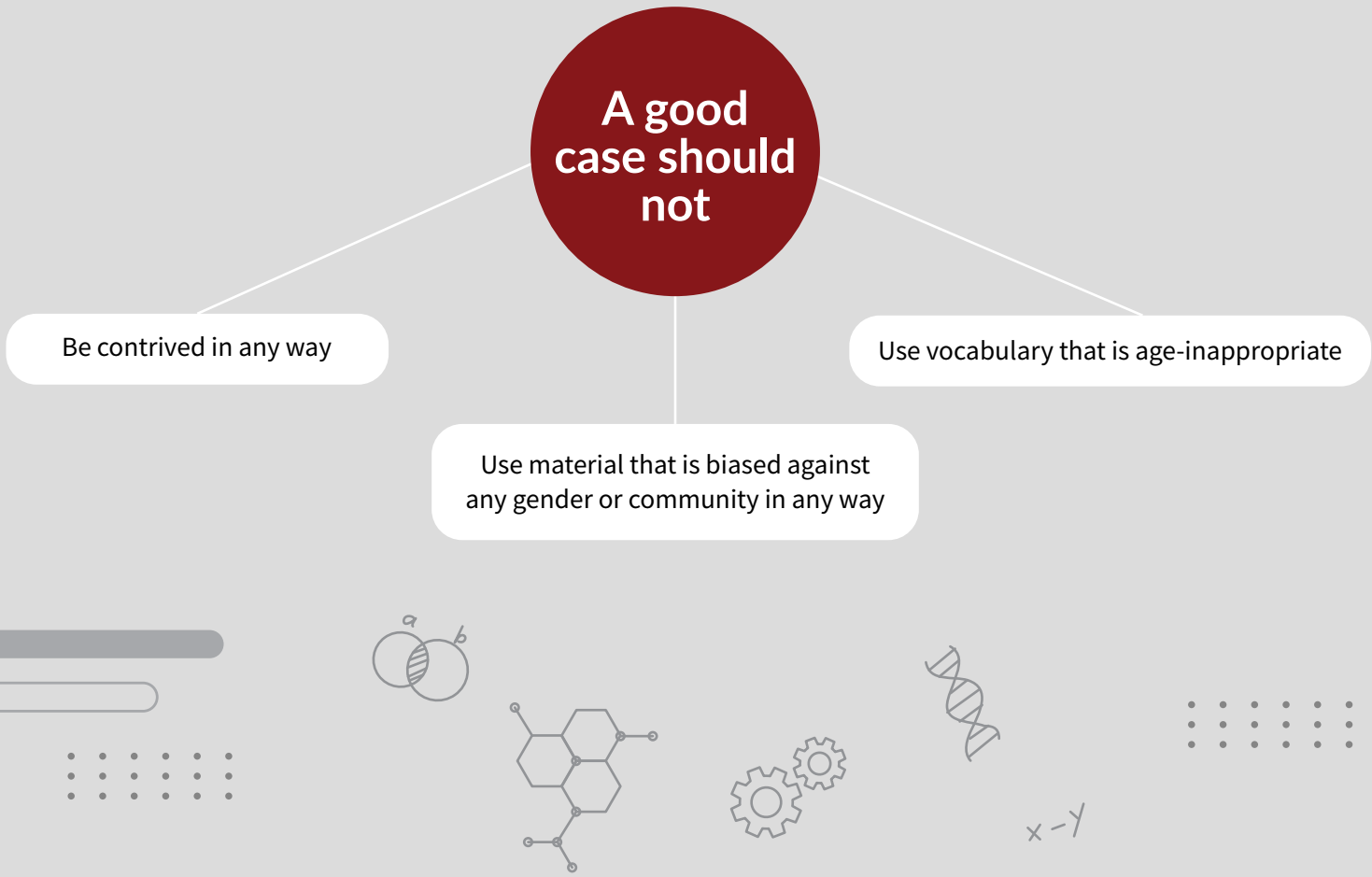
Question 2: TWISTED BUILDING
From which direction has Sideview 2 been drawn?

A From the North West | B From the North East
C From the South West | D From the South East

Source: PISA Released Items - Mathematics

Here are certain good practices recommended around use of case studies in assessments.





Here are a few examples of interesting case studies and related sample questions.

Sample Case Study 1 – *Social Studies*

The picture shown here depicts the traditional agricultural practices of the Apatani tribe in the Eastern Himalayas in Arunachal Pradesh, at a height of more than 1500 metres above sea level. The annual rainfall in this region is about 1750 mm. The traditional field shown in this picture is wet cultivation in irrigated valleys and on slightly terraced land around the valley.

1. How do the Apatanis manage to irrigate their valleys and hill terraces?

A By storing precious rainwater in wells and reservoirs

B By diverting small streams and springs and making temporary walls

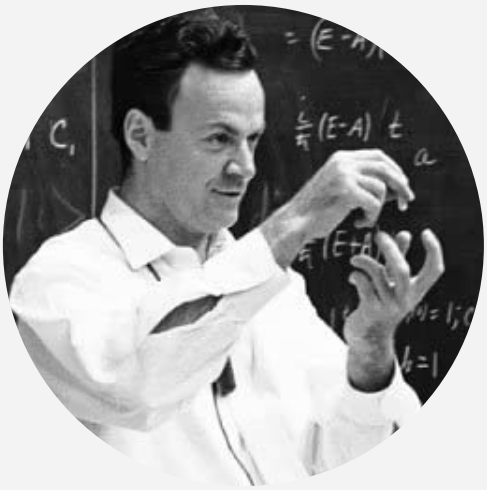
C By erecting a number of large dams on major rivers of the region

D By transporting water from low land plains through pipes

2. What crop is most likely to be cultivated in the fields shown above?

A Strawberry B Rice C Bamboo D Millet

Sample Case Study 2 – *Science*



The Amateur Scientist

At Alameda Street, some ants came out around the bathtub. I thought, "Here's a great oppurtunity to observe some of them." I put some sugar on the other end of the bathtub, and sat there the whole afternoon until an ant finally found the sugar. It's only a question of patience.

The moment the ant found the sugar, I picked up a coloured pencil that I had ready (I had previously done experiments indicating that the ants don't bother about pencil marks - they walk right over them - so I knew I wasn't disturbing anything), and behind where the ant went I drew a line so I could tell where his trail was. The ant wandered a little bit wrong to get back to the hole, so the line was quite wiggly, unlike a typical ant trail.

When the next ant to find the sugar began to go back, I marked his trail with another colour. (By the way, he followed the first ant's return trail back, rather than his own incoming trail. My theory is that when an ant has found some food, he leaves a much stronger trail than when he's just wandering around.)

This second ant was in a great hurry and followed, pretty much, the original trail. But because he was going so fast he would go straight out, as if he were gliding, when the trail was wiggly. Often, as the ant was "gliding," he would find the trail again. Already it was evident that the second ant's return was slightly straighter. With successive ants the same "improvement" of the trail by hurriedly and carelessly "following" it occurred.

I followed eight or ten ants with my pencil until their trails became a neat line right along the bathtub. It's something like sketching: You draw a clumsy line at first; then you go over it a few times and it makes a nice line after a while.

Surely You're Joking, Mr. Feynman by Richard P. Feynman. Some text has been modified for readability.

Same casestudy has been used in sample question 13 to highlight the importance of authentic context.

1. What did Richard Feynman's experiment MOST probably try to prove?

- **A** Ants wander about randomly to reach the ant hole from the food source
- **B** Once found, the ants used the same path from the food source to the ant hole
- **C** Using coloured pencils does not affect the movement of ants
- **D** You need eight to ten ants and a pencil to draw a straight line

2. Why did he use a pencil to mark the ants' trails?

- **A** Because he wanted to show the ants a direction and wanted them to follow a particular path each time they were moving back to the hole
- **B** Because he wanted to erase the trails the ants made while returning back to their hole
- **C** Because he knew that the pencil marks would disturb the ants and they would not be able to find the path to their hole easily
- **D** Because it would give a visual record of the path followed by the ants without affecting their path

3. Why was a different coloured pencil used for the second ant?

- **A** So that the second ant didn't recognize the trail the first ant had followed
- **B** So that the second ant's trail was not confused with that of the first ant
- **C** So that the first ant's trail could be erased while marking the second ant's trail
- **D** Because he was an amateur scientist and wanted everything to look colourful

4. What does the passage say about how the ants found the sugar?

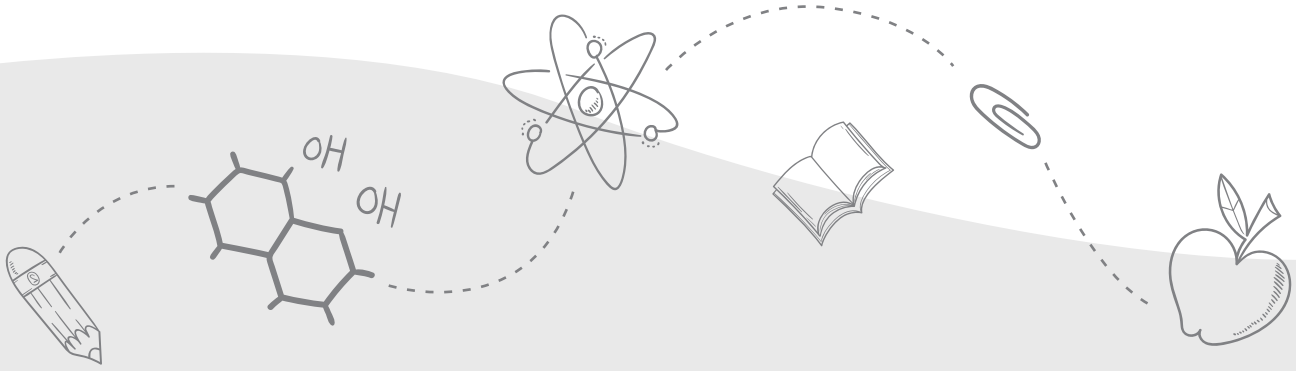
- A. All the ants followed the pencil marks to find the sugar
- B. The first ant found it accidentally while the others followed the pencil marks
- C. The first ant found it accidentally; nothing has been said about the other ants
- D. All the ants found it by following the earlier trails left by other ants

5. Assuming that the theory he proposed was correct, what would have happened if the sugar was suddenly removed?

- A. The ants will still keep following the trails made by other ants
- B. Some ants will start wandering while others will follow the paths forever
- C. The ants will follow the trail for a little while and then start wandering again
- D. The ants will start leaving even stronger trails in the absence of food

Key Takeaways:

1. ***Use information related to an engaging real-life context, from an authentic source.***
2. ***Ensure that the case is relevant and not outdated.***
3. ***Frame questions that can be answered based on the given information and not independently.***



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