

B 2 R 4 AC

READING PASSAGE 1

You should spend about 20 minutes on Questions 1-13, which are based on Reading Passage 1 below.

How to Draw a Geological Map

For keen amateur geologists, there's no better, practical way of increasing your knowledge, understanding and enjoyment of the subject, than to draw a geological map of an area that interests you. You will need a base map, a compass/clinometer¹, a magnifying lens, a bottle of diluted acid, a geological hammer for splitting rocks, and bags to collect samples. Before starting your mapping, it is worth researching the local geology, so you know what to expect.



inclined bedding



limestone



granite



basalt columns

The first thing to record is the rock type, or lithology. There are three main types of rock occurring on the Earth's surface: first, igneous rocks which formed from molten rock, either deep underground ('magma') or on the surface as 'lava' from volcanoes (on land or under the sea); second, sedimentary rocks, which are formed by the action of water or wind, such as rivers, glacier ice, desert wind, or the sea; and lastly metamorphic rocks, which can be either igneous or sedimentary rocks which have been altered by heat and pressure deep within the Earth's crust.

Sedimentary rocks are often found in bands, or 'bedding' and can be classified by the size of their particles. The finest particles form clay or shale (clay hardened by pressure). Silty clays or siltstones have a certain amount of fine, harder particles which can be felt between the fingers, while rocks with visible sand particles are examples of sandstone. When the particles are between 2mm across to pebble-sized or larger, the rocks are known as conglomerates or breccias. Conglomerates are rounded and formed in rivers or the sea, while breccias have sharp sides and are often of volcanic origin.

Another common type of sedimentary rock does not appear to be made of particles but appears crystalline. This is limestone and is formed of the mineral calcite (calcium carbonate) produced by the shells of sea creatures. It is soluble in acid, so observing bubbles of carbon dioxide while applying a little dilute acid on a freshly broken surface will help with identification. You can also observe the very distinctive deep holes or fissures found on many limestone surfaces which are known as 'limestone pavement'. These fissures are the result of the slightly acidic nature of rainwater

Most crystalline rocks, however, are igneous. When clear, or nearly clear crystals of quartz are present, the rock is referred to as 'acidic'. The best-known example of this is granite, a coarsely crystalline rock which forms from molten material deep in the Earth's crust, while quartz-free varieties are known as gabbro. When molten rock reaches the surface, especially in or near oceans, the rocks it forms are generally much darker, quartz-free rocks such as basalt.

Metamorphic rocks are also often crystalline, such as the pure white marble used for sculptures, and show the effect of temperature and pressure. One example of this is slate, which can be split into thin, even sheets and had been used for centuries on the roofs of buildings.

The structure of the rocks also needs to be recorded to complete your map. Sedimentary rocks are usually formed horizontally, so if their beds are sloped or inclined, it can give us a good indication of the underlying structure and how geological forces have affected the area in the past. Recording this allows you to predict both the pattern of rocks deeper underground and when the same rock may be seen again on the surface. Two measurements need to be recorded and the data put on your base map. The first is the 'strike' of the bed, how it is orientated in space; this is the line of no inclination and can be found using a clinometer, with the orientation measured with a compass. The second, incline of the bed (or 'dip') is measured at 90° to the strike line. Both measurements can be placed on your map in this way: F_{12°} (the longer line indicating the 'strike' and the shorter the 'dip' with its value added).

¹A clinometer measures the angle of a rock surface in degrees from the horizontal.



In this diagram the compass has recorded a strike direction of 008° (just east of magnetic north), with the clinometer measuring a dip of 12°.

Once you have recorded the boundaries of the different lithologies you have observed onto your base map, you can use your strike and dip data to work out the distribution of each rock type in areas where it is not exposed at the surface. If you find any fossils in your sedimentary rocks, these can give an indication of the age of the rocks using one of a wide range of available reference works.

Questions 1-7

Complete the table below.

Choose **NO MORE THAN TWO WORDS** from the passage for each answer.

Write your answers in boxes 1-7 on your answer sheet.

Rock types and the environments in which they are formed

Sedimentary rocks				Igneous rocks		
made of particles				made of crystals		
particle size fine \longrightarrow coarse				crystal size fine \longrightarrow coarse		
clay or shale	1. _____	sandstone	2. _____ or breccia	3. _____	basalt	granite or 4. _____
formed mainly in rivers or the sea				formed mainly in 5. _____	formed mainly in 6. _____	formed mainly in 7. _____

Questions 8-13

Do the following statements agree with the information given in Reading Passage 1?

In boxes 8-13 on your answer sheet, write

TRUE if the statement agrees with the information

FALSE if the statement contradicts the information

NOT GIVEN if there is no information on this

8. Igneous rocks are only formed deep in the earth's crust.
9. The presence or absence of certain minerals helps identify some rock types.
10. Igneous rocks make good building materials.
11. The oldest sedimentary rocks are found below more recent beds.
12. Rock strike is always perfectly horizontal.
13. Not all rocks contain fossils

READING PASSAGE 2

You should spend about 20 minutes on Questions 14-26, which are based on Reading Passage 2.

Questions 14-20

Reading Passage 2 has eight paragraphs, **A-H**

Choose the correct heading for each paragraph from the list of headings below.

Write the correct number, i-xi, in boxes 14-20 on your answer sheet.

Example	Answer
A	iii

- 14. Paragraph B
- 15. Paragraph C
- 16. Paragraph D
- 17. Paragraph E
- 18. Paragraph F
- 19. Paragraph G
- 20. Paragraph H

List of Headings	
i.	Types of food acquisition
ii.	Stable farming communities
iii.	Food is money
iv.	The origin of private ownership
v.	Food and income distribution
vi.	Conflicting interests
vii.	Natural hazards
viii.	Food and economic indicators
ix.	Staple foods
x.	Types of food production
xi.	Questions about ownership

Food and Economics¹

A. Where there is money, there are counterfeiters. Pre-contact Aztecs² had to keep an eye out for fake cacao beans as they accepted their wages and made their market purchases. A porter whose daily wage of one hundred beans turned out to include fakes made from wax, dough or avocado pits, might have trouble buying those two small rabbits, costing thirty beans each

B. Among the Aztecs and other ancient American people, food was quite literally currency. The same is true for historic Koreans, who paid their taxes in rice, while medieval Europeans gave pepper in payment. But food is part of economics in many different ways. If you want to know whether prehistoric people had a concept of private property, look for where they hid their food supplies. If you are curious about the origins of urban commercialism, think about when people began to trade extensively in staple foods the most basic of market commodities as opposed to prestigious delicacies. Reconstructing past foodways³ allows us to explore topics including labour costs and supplies, the extent of professional specialisation, resource distribution, and more.

C. Food production and procurement are huge topics. ‘Production’ refers to the raising of domesticated plants and animals. By ‘procurement’ people generally mean either the collection of wild resources or the acquisition of foods from other groups of people, via trade or exchange. Important questions include how food was produced or procured, the foods people produced / procured, and the quantity of the foods generated.

D. Different food production regimes require different amounts and types of labour, have different ecological impacts, and tend to lead to - and be caused by - different social outcomes. Consider, for example, the contrasting implications and opportunities afforded by small-scale household mixed farming (individual families tending their own fields and livestock) as opposed to large-scale, specialised crop farming and pastoralism (where planters and herders are spatially and socially distinct). People may produce the exact same foods using either strategy. They may not, however, lead broadly similar lives.

E. In small-scale household farming, livestock often graze on cropland that is not currently in use. The animals stay relatively close to home, walking ‘banks’ of meat, milk, blood, fat, manure, and other products. They convert unneeded or spoiled crops into edible food, and their dung fertilises the fields. Households are largely self-sufficient, although they rely closely on each other for social reasons, for periodic help with large projects, and as backups in case of emergency. Villages thus consist of multiple groups of people with roughly similar economic interests and identities.

¹Modified from Twiss KC 2019 The Archaeology of Food: Identity, Politics and Ideology in the Prehistoric and Historic Past. Cambridge: Cambridge University Press.

²The term ‘pre-contact Aztecs’ refers to a group of people living in Central America before contact with Europeans in the early sixteenth century

³Foodways the eating habits and culinary practices of a people, region, or historical period.

F. In contrast, specialised pastoralists move large herds long distances to pasture, potentially spending weeks or even months away from farmsteads and fields before returning to exchange their animal products for farmers' grain. Cultivation and herding are thus separate pursuits, potentially conducted by different households or kin groups. Specialised herder/cultivator economies are associated with distinct social identities and potential social conflict, despite mutual dependence on exchange. Such herder-farmer conflicts may have large-scale political and social implications. It has been suggested, for example, that these conflicts underpin the origins of empire in Asia. Conflicts between nomadic herders and farmers with permanent settlements led both groups to grow larger. The nomads needed greater numbers to continue raiding the farmers' crops, while the farmers needed more people to defend themselves and their food. Over time, both groups expanded their territories, eventually resulting in nomadic steppe⁴ confederations confronting settled agrarian empires.

G. How intensively people cultivate their land also has profound social implications. When a significant amount of labour was used to improve farmland, farmers were essentially investing in the land by adding value to it, which further enhanced their claims to ownership. This may help answer serious questions about when people first began to believe that land was something that could be owned, or to which access could be limited or denied.

H. One reason why it was seen as important for people to own the land where they produced or acquired their food is because some patches of land are more fertile than others. As a result, different plots provided different amounts of food, allowing some families to become considerably richer than others. Moreover, food surpluses produced by relatively successful households could be shared out to less productive ones, incurring debts or obligations that the less productive families carried into the future. A system of food production can, in this way, set the stage for lasting social inequalities.

⁴Steppe - A huge grassy plain with very few trees

⁵Agrarian - Relating to farming or agriculture

Questions 21-26

Do the following statements agree with the claims of the writer in Reading Passage 2?

In boxes 21-26 on your answer sheet, write

YES *if the statement agrees with the claims of the writer*

NO *if the statement contradicts the claims of the writer*

NOT GIVEN *if it is impossible to say what the writer thinks about this*

21. Different ways of producing food led to different political and social structures.
22. Farmers increasingly resented the demands of the pastoralists.
23. Both farmers and pastoralists are mainly involved in food 'production'.
24. Increased population sizes led to conflict.
25. Food stuffs are still used instead of money today.
26. Different qualities of land led to income inequalities.

READING PASSAGE 3

You should spend about 20 minutes on Questions 27-40, which are based on Reading Passage 3 below.

Colour Blindness

Colour blindness is a condition where sufferers cannot recognise different colours or distinguish different colour shades or brightness. Not sensing the difference between red and green is the most common, though some cannot distinguish blue and yellow, while in complete colour blindness, which is rare, colours can't be distinguished at all. It is estimated that there are over 300 million colour blind people in the world, though it is more common in areas with a higher proportion of white, European populations, while it is relatively rare in sub-Saharan Africa. On average, one in twelve men have the condition, while it affects just one in two hundred women.

Red-green colour blindness is a genetic disorder and is generally passed from mothers to sons. The gene responsible is carried on one of the X sex chromosomes. Since men have only one X chromosome, if a man's X chromosome carries the condition, he will be colour blind. A woman can have one of two types of X chromosomes: either two normal X chromosomes or one normal and one carrier X chromosome. If a woman has two normal X chromosomes, she will not be colour blind or a carrier. On the other hand, if she has one normal and one carrier X chromosome, she can pass on the condition to her children. There is a 50% chance that her sons will be colour blind, and a 50% chance that her daughters will be carriers. Rarely, a woman may inherit carrier genes from both her mother and her father, which means she will be colour blind herself and will pass it on to her sons, while her daughters will also be carriers. Blue/yellow and complete colour blindness are carried on non-sex chromosomes and affect both men and women equally. Some may become colour blind later in life as a result of diseases, such as diabetes, or as a side effect of medication.

The back of the eye, or 'retina', has two sorts of light-sensitive nerve cells: rods and cones. Rods work in low-light conditions and help with night vision, while cones work in daylight and are responsible for colour discrimination. There are three types of cone cells, one of which sees red light, another green, while the third detects blue light. When combined, the brain can perceive the colour of an object: this is referred to as 'Trichromacy'. Colour blindness occurs when one or more of the signals from the cones is 'faulty' (known as 'Anomalous Trichromacy'), while in severe cases, one or more cones do not work at all. Reduced sensitivity to red light is known as 'Protanopia', to green light is 'Deuteranopia' and to blue light, which is extremely rare, 'Tritanopia'. When no colour can be perceived, it is known as 'Monochromacy' or 'Achromatopia'.

Colour blindness can have an impact on many aspects of daily life, including education and business where colour is used extensively in documents and visual materials. In addition, colour blindness can restrict career choice. For example, in some roles in the transport sector or armed forces, colour blindness could create safety risks. Colour blindness can also impact day-to-day activities such as choosing clothes and applying make-up. It may also make it difficult to determine whether fruit is ripe enough to eat or if meat is properly cooked. Many people with impaired colour vision develop alternative coping strategies such as touching or smelling items or using a cooking thermometer to see if meat is cooked through.

Several potential treatments for colour blindness have been suggested such as EnChroma glasses, which have been widely advertised as a way to 'ease red-green colour blindness! However, the company admits that the glasses are not a complete cure and may not be effective in severe cases. Studies have shown that while the glasses may improve the ability to distinguish some colours, they can also make it more challenging to identify other colours, causing 'new difficulties in colour perception. In recent years, researchers have begun looking at the potential of gene therapy to provide a cure, although this has not yet gone beyond experiments with animals. In the meantime, there are a number of strategies that can be helpful for those with colour blindness. Among the most useful are a set of smartphone apps which can help users to identify colours, and the World Wide Web Consortium has published a set of guides on colour use to make web pages clearer to those suffering from colour blindness.

It may be years before an effective treatment for colour blindness is developed. Yet, a lot can be done to lessen its impact. For example, schools can ensure that classrooms contain lots of natural light as this affects the way colours are perceived, and employers can review processes and systems to ensure that they are 'colour blind-friendly'. There are many colour-blind artists and illustrators, some of whom have computer programmes that help them to identify different hues. The 'Colour Vision Defective Pilots' Association' believes that colour blindness does not affect a person's ability to pilot a plane and has been successful in legally challenging a number of employers in the air industry. Colour blindness may be common, but it is not necessarily a handicap.

Questions 27-30

Choose the correct letter A, B, C or D

Write the correct letter in boxes 27-30 on your answer sheet.

27. Colour blindness is likely to be least common in:
- A. men of European ethnicity.
 - B. black men.
 - C. women of European ethnicity.
 - D. black women.
28. A colour-blind mother will have:
- A. colour-blind sons.
 - B. colour-blind daughters.
 - C. both colour-blind sons and colour-blind daughters.
 - D. neither colour-blind sons nor colour-blind daughters.
29. Full colour perception is known as:
- A. achromatopsia
 - B. deuteranopia
 - C. trichromacy
 - D. tritanopia
30. Problems associated with colour blindness can best be alleviated using:
- A. EnChroma glasses.
 - B. gene therapy.
 - C. phone apps.
 - D. websites.

Questions 31-40

Complete the summary using the list of words, A-P below.

Write the correct letter, **A-P**, in boxes 31-40 on your answer sheet.

Colour blindness: a condition the world is blind to

31. _____ colour blindness is a genetic condition carried by a 32. _____ X chromosome, and consequently is most 33. _____ developed in males. However, 34. _____ blindness, which is less common, can be developed in both males and females. Such 35. _____ trichromacy results from parts of the eye's 36. _____ – referred to as 'cones' - do not work correctly. The condition can impact daily life, such as when choosing clothes or make-up, or judging whether food is ready to eat. However, colour-blind people have developed a number of 37. _____ strategies, such as using phone apps to detect colour. More seriously, colour blindness is a condition that can prevent progress in employment, either when sufferers feel there are restrictions in career choice, or when employers impose them. However, pressure groups believe simple 38. _____ to current practice is all that is needed to cater for colour-blind workers. Meanwhile, research on finding a cure for colour blindness continues, including 39. _____ therapy, though this is still in its 40. _____ stages.

A. rare	B. red-green	C. experimental	D. diabetes
E. anomalous	F. cornea	G. commonly	H. retina
I. blue-yellow	J. mutant	K. adaptations	L. safety
M. trichromacy	N. gene	O. coping	P. blue-yellow

Answers – B 2 R 4 AC

Reading Passage 1

Questions 1-13

1. 'silt' or 'siltstones'

They may have a certain amount of fine, harder particles which may be difficult to see but easy to feel if you put just a small sample between your teeth - these are silty clays or siltstones'.

2. conglomerate(s)

When the particles are over 2mm across, to pebble-sized or larger, the rocks are known as conglomerates'.

3. limestone(s)

'Another common type of sedimentary rock does not appear to be made of particles but appears crystalline: this is limestone'.

4. gabbro(s)

'Coarser varieties, which formed at depth, include gabbros'.

5. (the) sea

limestone and is formed... largely by the shells of sea creatures'.

6. volcanoes

rocks which cool quickly at the surface during volcanic eruptions include basalt.

7. (the) crust

coarsely crystalline rock granite is the best-known example, which forms deep in the crust

8. FALSE

They are formed both in the crust AND on the surface at volcanoes.

9. TRUE

Particularly in differentiating between 'acid' and 'basic' igneous rocks due to the presence or absence of quartz.

10. NOT GIVEN

Though some uses of metamorphic rocks were given, no mention is made of the commercial use of igneous rocks.

11. NOT GIVEN

Though this is true, it is not mentioned in the text and so is 'not given'.

12. TRUE

'the strike' of the bed is the line of no inclination'.

13. TRUE

Only sedimentary rocks (and some metamorphic rocks, such as slate) contain fossils; no igneous rocks do.

14. viii (food and economic indicators)

While the first paragraph summarises the theme of the preceding first paragraph food is money - the bulk of the paragraph links the study of food, and 'foodways' to a range of economic indicators, such as labour costs and the concept of private property. Though staple foods are mentioned (option 'ix'), they are not an important part of this paragraph.

15. i (types of food acquisition)

This paragraph distinguishes the two ways food is obtained, or acquired, either by 'production' or 'procurement'.

16. x (types of food production)

This paragraph contrasts small- and large-scale farming types.

17. ii (stable farming communities)

This paragraph describes self-sufficient communities with none of the conflicts outlined in the following paragraph about pastoralists.

18. vi (conflicting interests)

This paragraph mentions the potential of conflict between pastoralists and cultivators.

19. xi (questions about ownership)

This short paragraph poses questions for archaeologists on the origin of the concept of, or rights to private property. It does not discuss the origin of private ownership (option 'iv'), only that it is an area investigated by archaeologists.

20. v (food and income distribution)

This paragraph introduces the idea of income inequalities. The natural hazards of 'flooding and other natural damage are mentioned, 'natural hazards' (option 'vii') does not form a significant part of this paragraph.

21. YES

The difference between pastoralists and farmers led to different polities, highlighted in Paragraph F, for example: 'The two groups alternated expanding their polities, until steppe confederations were facing agrarian empires..

22. NOT GIVEN

No information is given about the farmers attitude to the pastoralists, though they could be inferred.

23. NO

Pastoralists are mainly involved in 'procurement'.

24. NO

The other way around, according to the text 'conflicts between nomadic pastoralists and settled farmers pushed both groups to increase their group sizes'.

25. YES

In Paragraph B it states: 'The modern University of Bath annually presents a single peppercorn to the regional council as rent for its campus'. This is a tradition in the UK dating back to the late fifteenth century onwards, when a single peppercorn was given as a nominal, low-value amount, while still retaining the legal status of a lease, leading to the English expression of a 'peppercorn rent' for any symbolic sum.

26. YES

The text mentions, 'When different groups of people (families, for example) exploit different plots of land, they acquire different amounts of food [and] may become considerably richer than others..

Reading Passage 3

Questions 27-40

27. D (Black women)

While men and white Europeans are more prone to colour blindness, black women are least susceptible.

28. A (Colour-blind sons)

'a woman [who is] colour blind herself... will pass it on to her sons'.

29. C (trichromacy)

When the brain can perceive the colour of an object: this is referred to as 'trichromacy'.

30. C (Phone apps)

EnChroma glasses can 'alleviate old problems but create new, equally confusing colour sensing', gene therapy 'has not yet gone beyond experiments with animals', and websites are not discussed in alleviating colour blindness. This leaves phone apps 'which can identify colours',

31. B (red-green)

This is the variety carried by the X chromosome.

32. I (mutant)

This is a defective X chromosome.

33. F (commonly)

Because of it being carried by the X chromosome, it is more common in males.

34. O (blue-yellow)

Blue/yellow... blindness [is] carried on non-sex chromosomes and affect both men and women equally!

35. D (anomalous)

These types of trichromacy cause colour blindness, and so are 'anomalous'.

36. G (retina)

'The back of the eye, or 'retina', has two sorts of light-sensitive nerve cells'

37. N (coping)

[colour-blind people] develop alternative, coping strategies!

38. J (adaptations)

Other employers should review their processes and procedures to help those with colour blindness.

39. M (gene)

There has been research to see if gene therapy may lead to a cure...

40. C (experimental)

'Though this has not yet gone beyond experiments with animals.'

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