

STRUCTURAL LANDFORMS

KEY CONCEPTS:

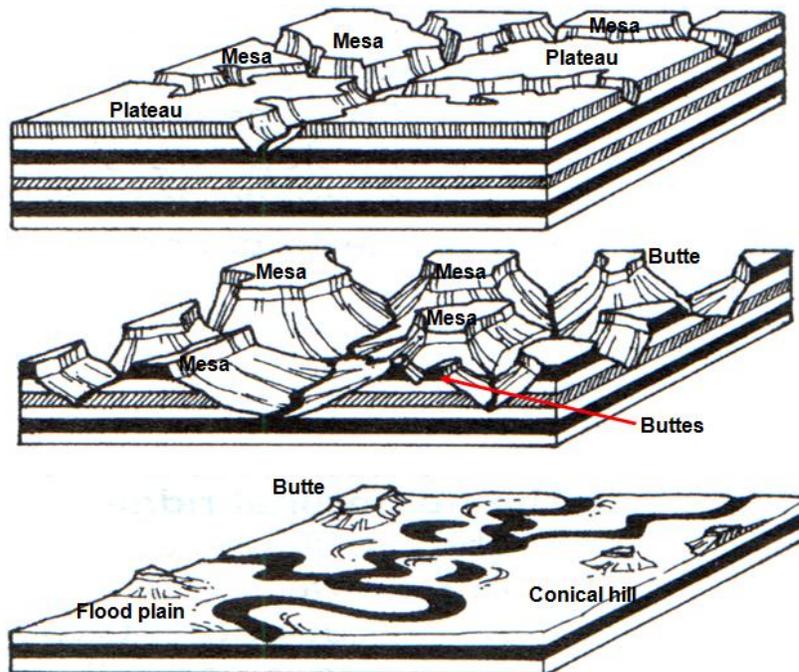
- Topography of Horizontal Strata
- Landforms associated with Inclined Rock Strata
- Landforms Associated with Igneous Intrusions

X-PLANATION

TOPOGRAPHY OF HORIZONTAL STRATA

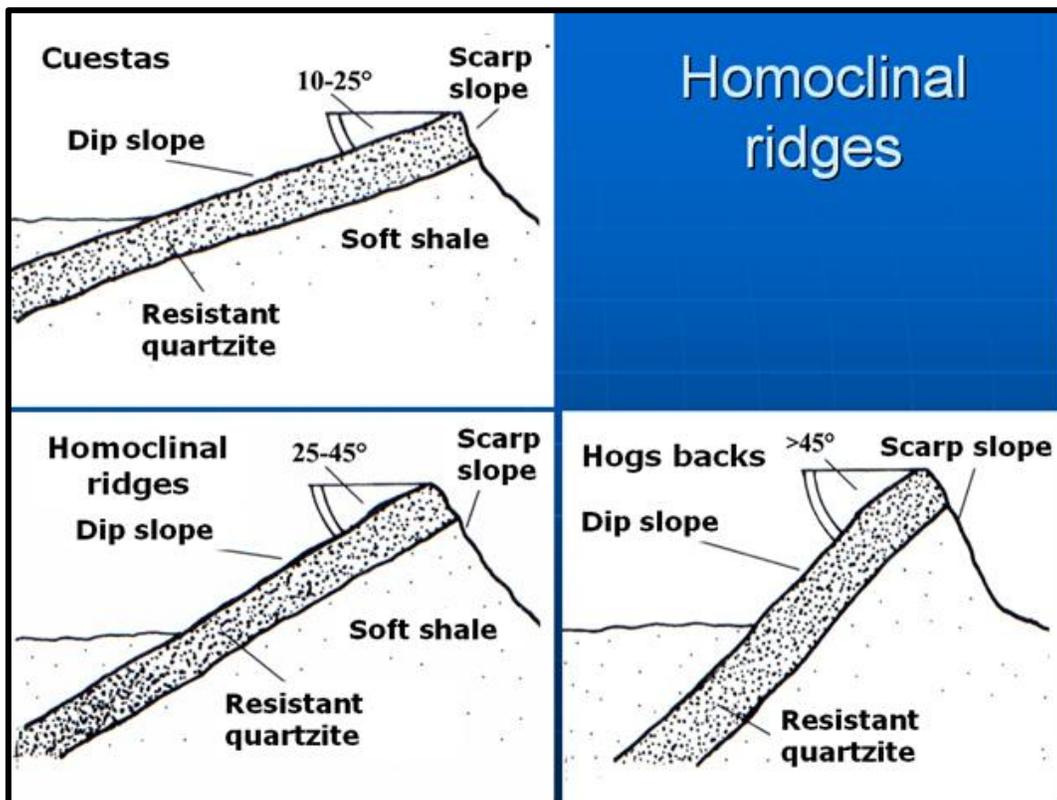
- Sedimentary rock with igneous sills that are horizontal to the surface.
- Harder sills prevent erosion and form flat tops of landscapes, e.g. the Basaltic plateau of Lesotho.
- Plateaus are cut smaller into mesas, buttes and, when the hard layers are removed completely, conical hills.
- In dry areas where exotic rivers occur, canyons develop due to the dominance of stream erosion and the absence of sheet erosion.
- In areas with uniform rock, hilly landscapes will develop like the badlands in North America.

A plateau is cut down into mesa, mesas are cut into buttes, and buttes become conical hills. The plateau is changed into a plain.

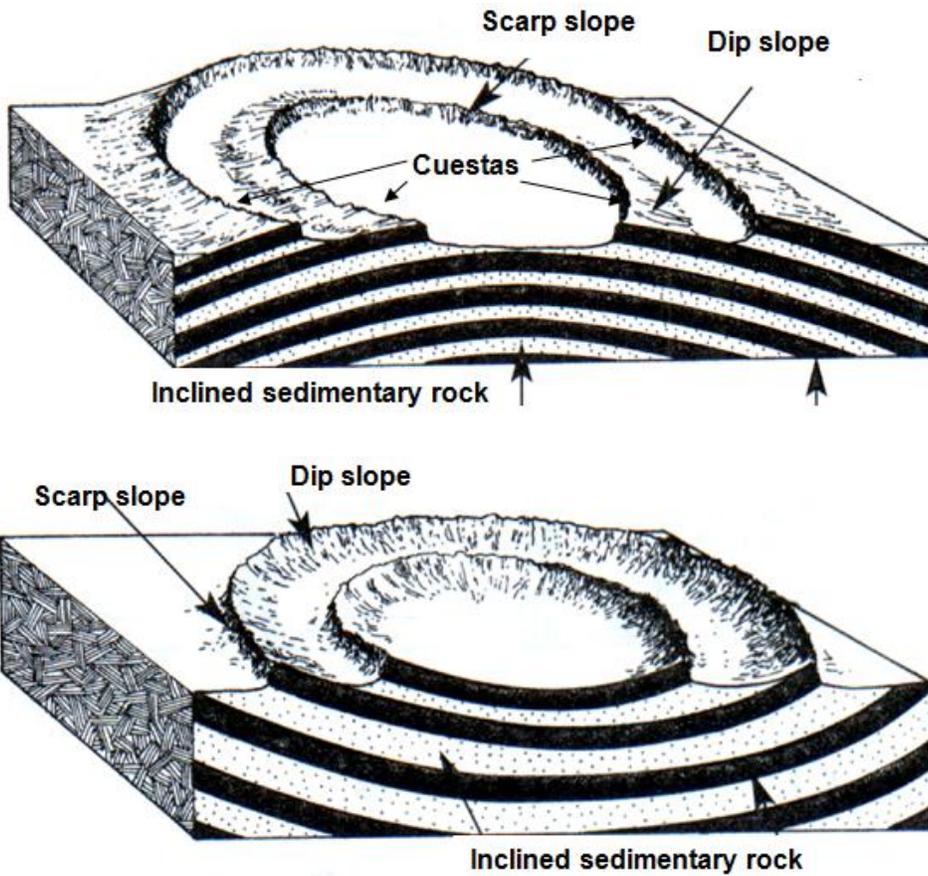


LANDFORMS ASSOCIATED WITH INCLINED ROCK STRATA.

- Rock has been bent or inclined due to pressure in the crust or igneous intrusions.
- The inclined rock consists of sedimentary and metamorphic rock.
- When homoclinal ridges develop, they always have a dip and a scarp slope on either side.
- The gradient of the angle of inclination determines the landform:
 - **Cuestas** – inclined between 10° and 25° ,
Steep scarp slope and gradual dip slope.
 - **Homoclinal ridges** – inclined 25° - 45° ,
Dip slope not so gradual and scarp slope steeper.
 - **Hogbacks** – Inclined $> 45^{\circ}$,
Dip and scarp slope nearly the same.
- Erosion takes place faster along the steep scarp slope and towards the dip slope, because the scarp slope is steeper and some of the softer rock is exposed along the scarp slope.

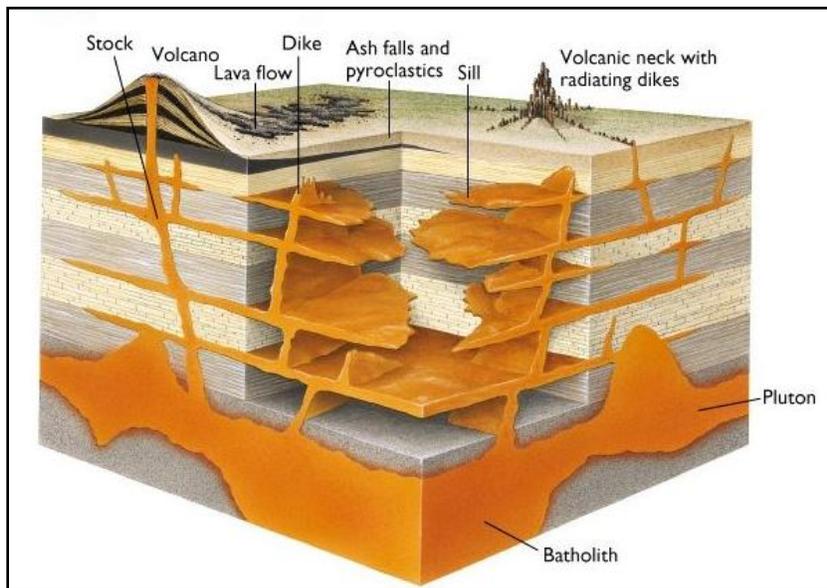


Where layers have been bent in concentric circles like the next two sketches, homoclinal ridges will form as the layers are eroded.



Volcanic intrusions: igneous rock cool down in the crustal layers or earth.

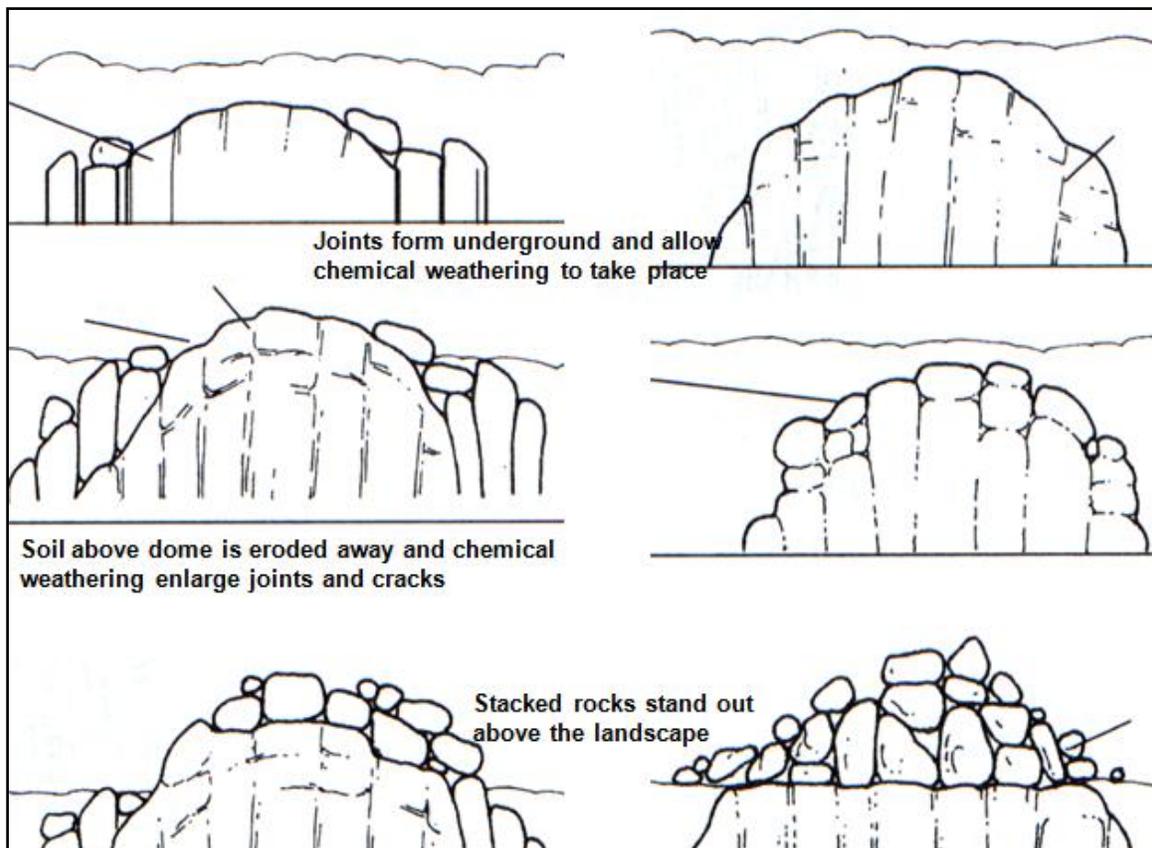
Types of Igneous Structures:



Batholith	Large mass of igneous rock that solidifies deep under the surface in a dome shaped intrusion
Sill	Layer of igneous rock that solidifies parallel and horizontal with sedimentary rock
Dyke	Igneous rock solidifies in a fissure, cutting vertically through the existing rock layers
Lopolith	A saucer shaped igneous intrusion that form deep under the surface and bends the layer below it down
Laccolith	A mushroom shaped igneous intrusion which forms near to the surface and bends the layers above it upward
Pipe	Cylindrical intrusion through which magma is pushed to the surface

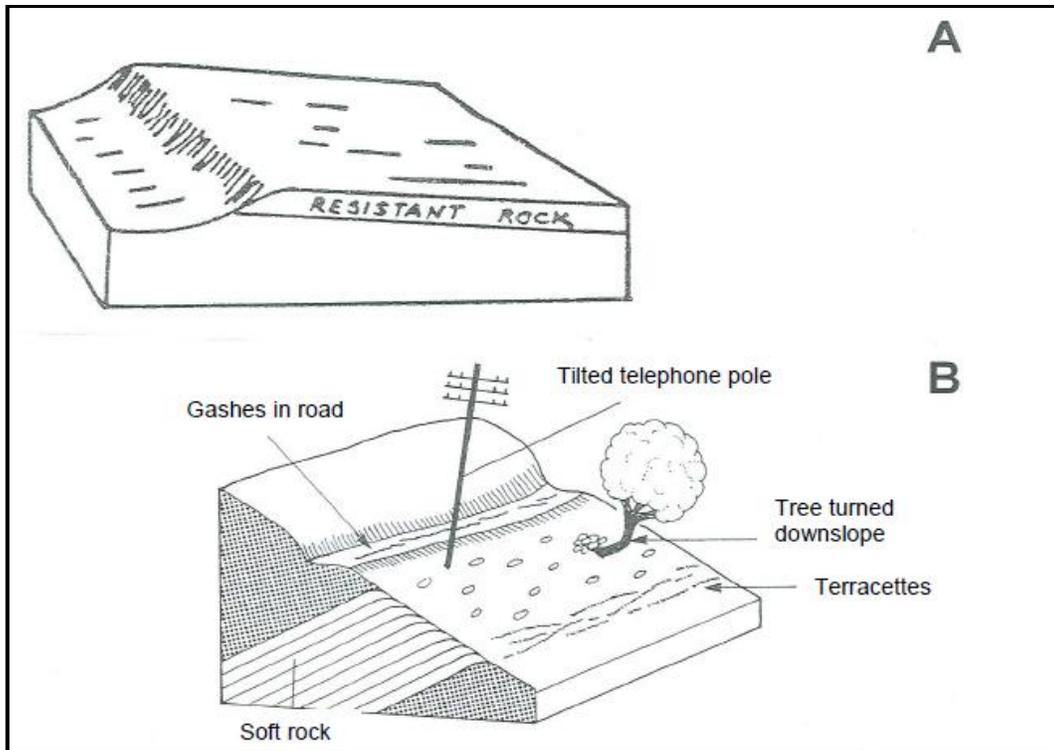
LANDFORMS ASSOCIATED WITH IGNEOUS INTRUSIONS

- Igneous intrusions form when magma solidifies amongst sedimentary and metamorphic rock, e.g. Batholiths, sills, dykes, laccoliths, Lopolith and pipes.
- Exfoliation domes form when large pieces of granite is exposed to the surface, and rounded by exfoliation due to temperature changes.
- Tors form when the granite dome is jointed under the surface, and chemical weathering enlarges the joints and cracks. When the granite is exposed to the surface, all the weathered material is eroded away and a stack of boulders are left on the surface.



X-AMPLE QUESTIONS

QUESTION 1: (DoE Exemplar 2008)



- 1.1 FIGURE A above shows a landform typically found in South Africa. FIGURE B shows the process of mass movement that will take place on the slopes of the illustrated landform.
- (a) Identify the landform (feature) illustrated in FIGURE A. (1 x 2) (2)
 - (b) Explain, with reference to the underlying rock structure, how the landform identified in QUESTION 1(a), developed. (3 x 2) (6)
- 1.2
- (a) What type of mass movement is illustrated in FIGURE B? (1 x 2) (2)
 - (b) Provide evidence from FIGURE B that mass movement is taking place. (1 x 2) (2)
 - (c) On which slope, the dip slope or the scarp slope, is mass movement more likely to take place? (1 x 2) (2)
 - (d) Explain your answer to QUESTION 1.2(c). (2 x 2) (4)
 - (e) Why do you think people should be made aware of the consequences of mass movement before building on slopes? (2 x 2) (4)
 - (f) Name ONE way in which slopes can be stabilised (reinforced) to reduce mass movement. (1 x 2) (2)

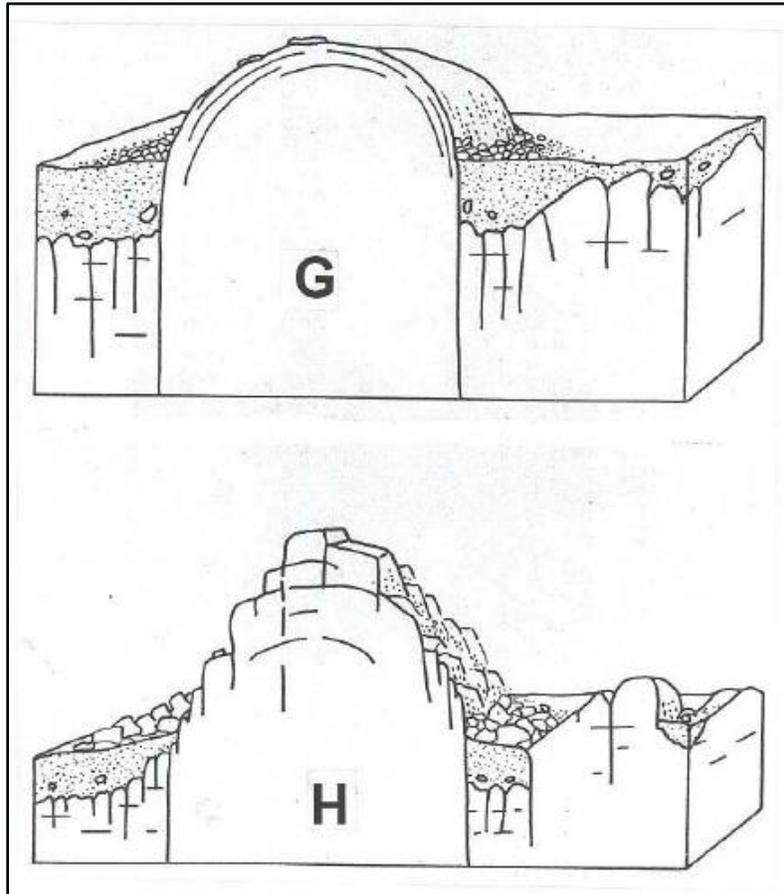
[24]

HINTS

Hint 1 – Look at the angle of inclination on the sketch; in this sketch it is less than 25°

Hint 2 – Know the sketches and definitions very well.

QUESTION 2: (Source: DoE March 2009)



The FIGURE above illustrates the development of a structural landform associated with massive igneous rock.

- 2.1 Identify the landforms labelled G and H respectively. (2 x 2) (4)
- 2.2 Name the original underground igneous landform from which landforms G and H originated. (1 x 2) (2)
- 2.3 Briefly explain how landform H develops. (3 x 2) (6)
- 2.4 Briefly explain how landform G develops. (3 x 2) (6)
- 2.5. What drainage pattern will develop on landform G? (1 x 2) (2)
- 2.6. Explain why the drainage pattern you have identified in 1.5 will develop at G. (1 x 2) (2)

[22]

QUESTION 3: (Source: DoE Nov 2010)

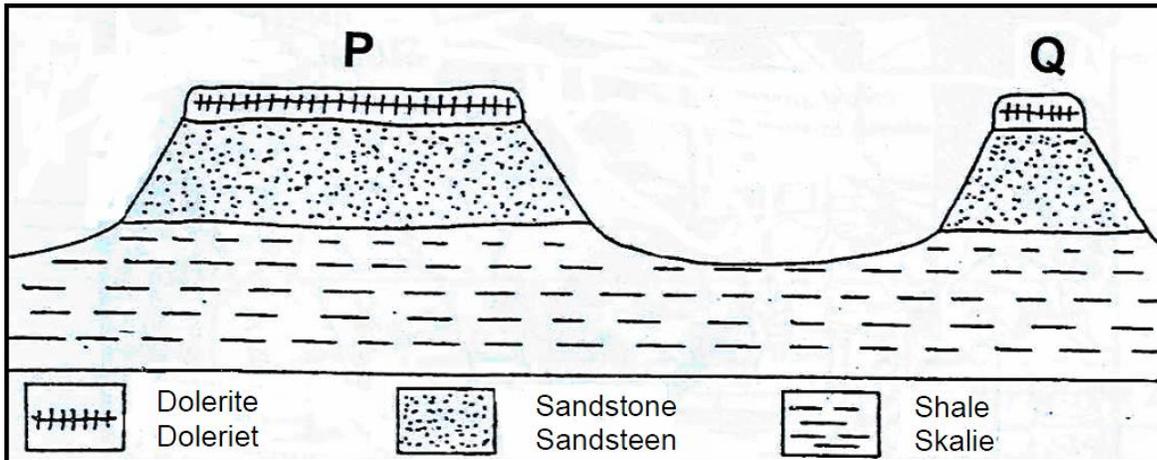


FIGURE 3

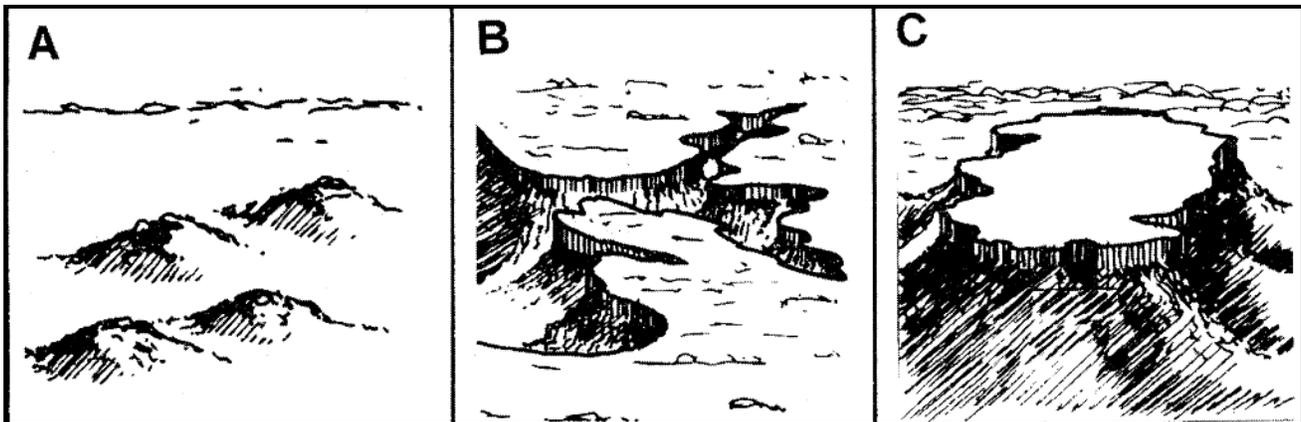
FIGURE 3 above illustrates a structural landscape typically found in the Karoo.

- 3.1 Identify landforms **P** and **Q** respectively. (2 x 2) (4)
 - 3.2 What evidence in the FIGURE 3 suggests that landforms **P** and **Q** developed from the same landform that existed earlier? (2 x 2) (2)
 - 3.3 Which rock type in the FIGURE 3 is the most resistant to erosion? (1 x 2) (2)
 - 3.4 Give ONE reason for your answer to QUESTION 3.3. (1 x 2) (2)
 - 3.5 Briefly describe how landform **P** will change into landform **Q**. (3 x 2) (6)
- [16]

QUESTION 4: (Source: DoE March 2010)

Refer to the figure below showing the development of a landscape associated with horizontal sedimentary rock. The three diagrams are not arranged in the correct order of development.

- 4.1 Arrange the three diagrams in the correct order of development by writing the letters that appear on the diagrams in the correct order. (3 x 2) (6)
 - 4.2. The utilisation of landscape B by humans is limited. Explain the reason for this. (2 x 2) (4)
 - 4.3. Which ONE of the diagrams illustrates a typical Karoo landscape? (1 x 2) (2)
 - 4.4. Identify the landform in the diagram mentioned in QUESTION 4.3, that is typically found in the Karoo landscape. (1 x 2) (2)
 - 4.5. Give a reason why cuestas will not develop in the landscape visible in the figure below: (1 x 2) (2)
- [16]



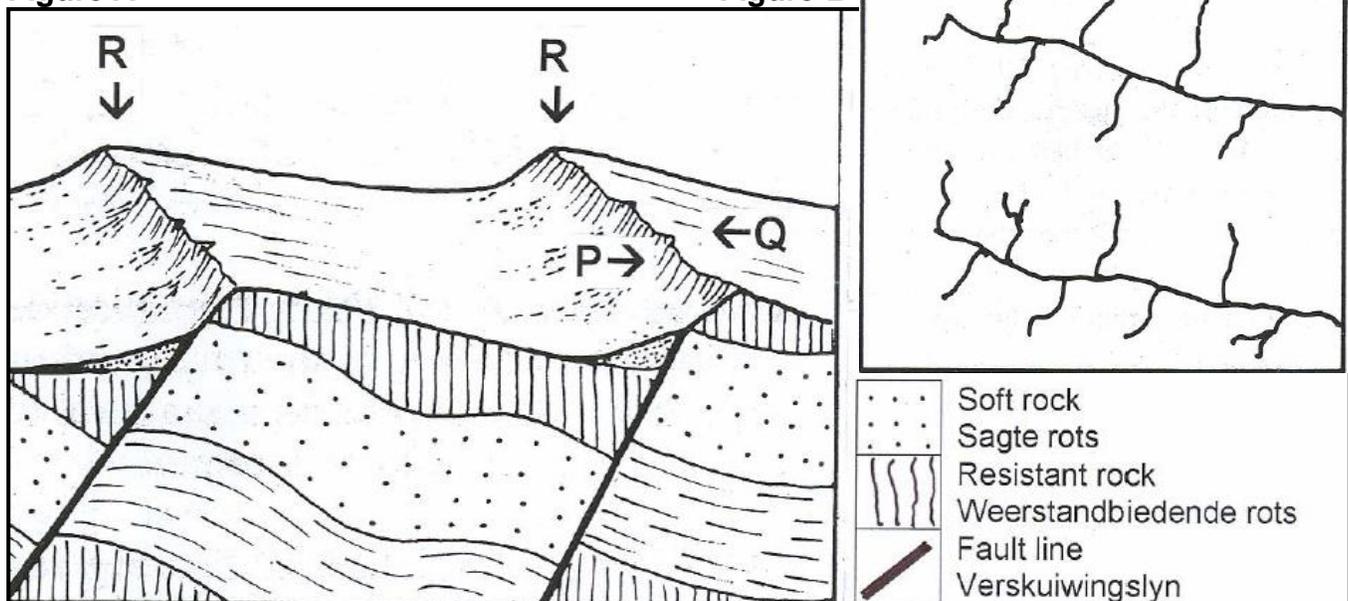
QUESTION 5: (Source: DoE Nov 2009)

Refer to the FIGURE A and B below showing a landscape typical of inclined sedimentary layers. FIGURE B illustrates a drainage pattern that will most likely develop in the landscape shown in FIGURE A.

- 5.1. Name the landforms labelled R in FIGURE A. (1 x 2) (2)
- 5.2. Briefly describe the development of the landscape illustrated in FIGURE A. (3 x 2) (6)
- 5.3. Name the drainage pattern illustrated in FIGURE B that will develop in the landscape shown in FIGURE A. (1 x 2) (2)
- 5.4. Explain why the drainage pattern mentioned in QUESTION 5.3 will develop in this landscape. (3 x 2) (6)

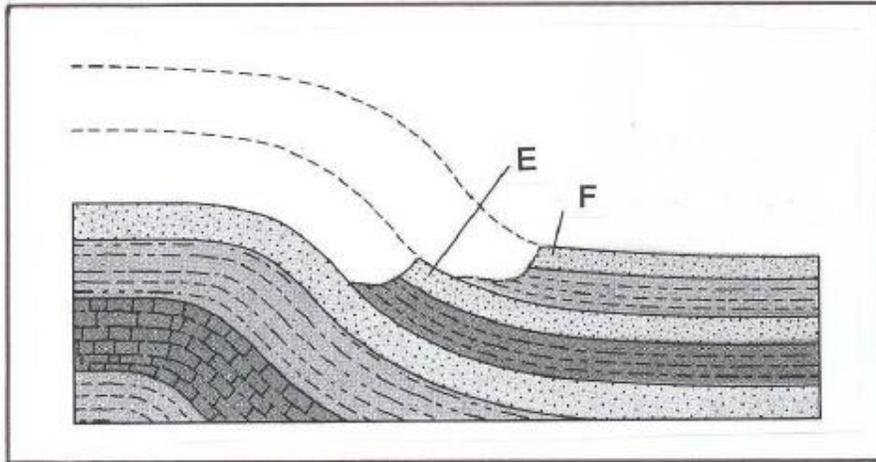
Figure A

Figure B



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QUESTION 6: (Source: DoE March 2009)

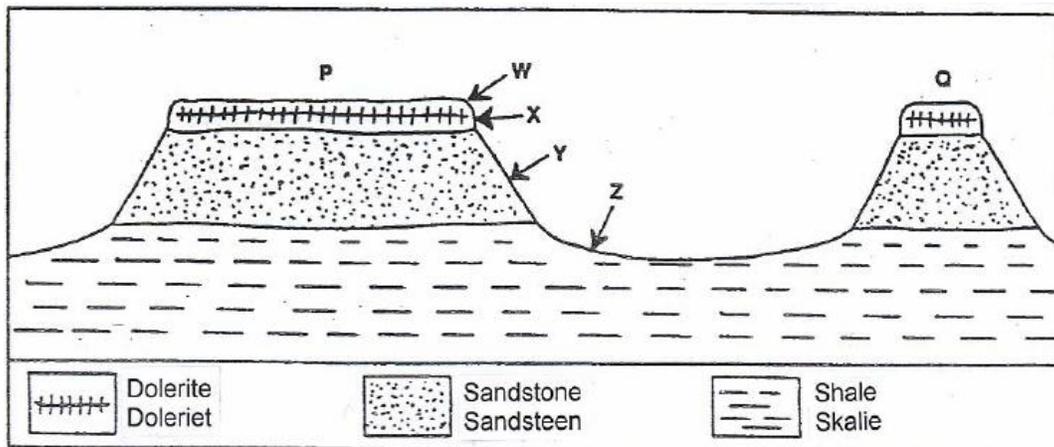


Rocks have different types of strata which give rise to unique landforms. Use the figure above to observe some of these landforms and answer the questions that follow.

- 6.1 Identify the features (landforms) labelled E and F. (2 x 2) (4)
 - 6.2 Give ONE difference between feature (landform) E and F. (1 x 2) (2)
 - 6.3 Of what value is this landscape to man? Give TWO reasons. (2 x 2) (4)
- [10]

QUESTION 7: (Source: DoE March 2009)

- 7.1. Refer to the FIGURE below showing a landscape found in South Africa. Four options are provided as possible answers to the following questions. Choose the answer and write only the letter (A – D) next to the question number.

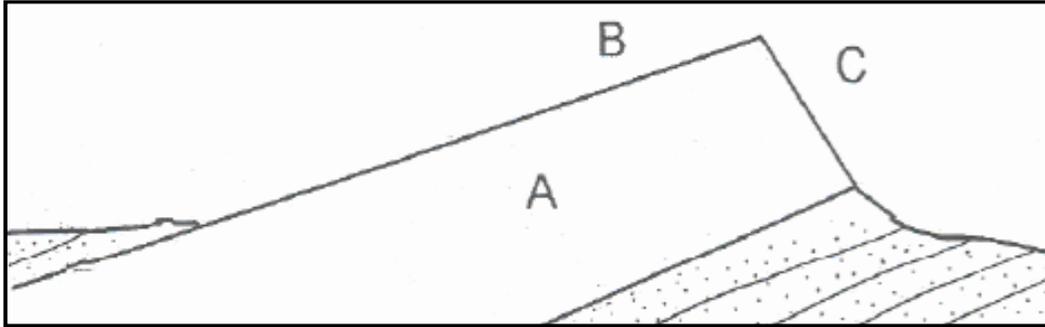


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- 7.1 The landscape illustrated in the figure above is associated with ... rock.
- A massive igneous
 - B horizontal sedimentary
 - C tilted igneous
 - D tilted sedimentary
- 7.2 Landform P is a ...
- A mesa.
 - B cuesta.
 - C butte.
 - D tor.
- 7.3 Slope element Z is the ...
- A crest.
 - B cliff.
 - C talus.
 - D pediment.
- 7.4 The landscape is typical of ... regions in South Africa.
- A humid and hot
 - B dry and hot
 - C humid and cold
 - D dry and cold
- 7.5 The landscape is typical in ...
- A Mpumalanga.
 - B KwaZulu-Natal.
 - C the Northern Cape.
 - D Gauteng.

(5 x 2) [10]

QUESTION 8: (Source: DoE September 2008)



Refer to the figure above showing a ridge labelled A.

- 8.1 (a) Identify the ridge labelled A. (1 x 2) (2)
(b) State ONE significance of ridge A to humans. (1 x 2) (2)
(c) Briefly explain the formation of ridge A. (3 x 2) (6)
- 8.2 Identify slopes B and C respectively. (2 x 2) (4)
- 8.3 Mesas will not develop in this landscape. Give a reason why this is so. (1 x 2) (2)
- [16]