

SECTION B

*Questions 5-7 relate to the **British Geological Survey 1:50 000 geological map** extract from the **New Cumnock (Solid) Sheet**.*

*Answer **all** questions in the spaces provided.*

This section should take approximately 1 hour to complete.

5. (a) Refer to the **Geological Map.**

- (i) State the angle of dip of the inclined strata within the Kirkcolm Formation (KKF), shown by the dip symbol close to **grid reference (GR) 760167**. [1]

Dip degrees

- (ii) Describe the measurements that must have been made at this locality so that the dip symbol could be plotted. You may wish to use an annotated diagram(s). [3]

- (b) The Southern Upland Fault (**grid square 7518**) has been active since the Early Palaeozoic and has a long history of reactivation into the Tertiary. Complete **Table 5** to describe the main fault characteristics shown by **map evidence alone**. [3]

Fault characteristics on geological map	Southern Upland Fault
Dip direction and angle (degrees)	NW at approximately 85°
Strike directions	•
Downthrow direction	•
Fault type	•

Table 5

(c) The granodiorite (**G^D - grid square 7718**) is part of a large igneous pluton.

- (i) State the maximum and minimum width of outcrop of the metamorphic aureole south of **gridline 18**. Give your answer in metres (m). [2]

	Metamorphic aureole outcrop width (m)
Maximum	•
Minimum	•

- (ii) Draw an annotated diagram(s) to explain how the width of outcrop of the metamorphic aureole may reflect a variation in the dip of the contact between the pluton and the country rock. [2]

- (iii) Give **one** other possible explanation for the variation in outcrop width of the metamorphic aureole. [2]

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Total 13 marks

6. **Figure 6a** shows a **vertical cliff section** through a Siluro-Devonian conglomerate (**cg**), typical of those within the Auchtitench Formation (**AUC**), **grid square 7016**.

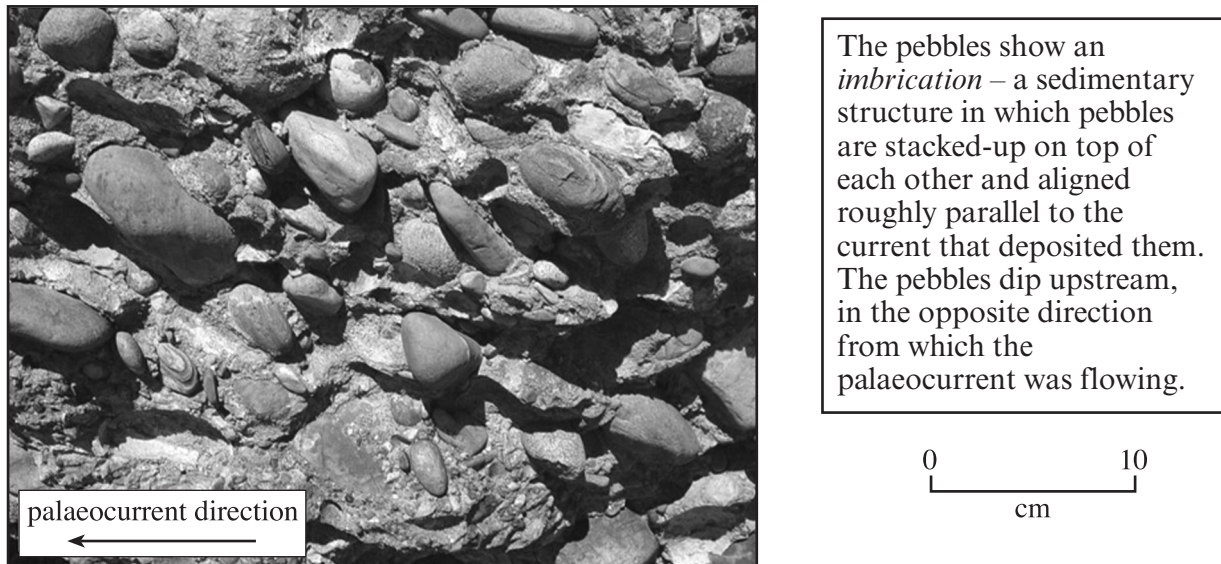


Figure 6a

- (a) (i) Describe the evidence from **Figure 6a** that suggests these conglomerates were deposited by flash floods. [3]

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- (ii) With reference to the **cross-section (P-Q)**, describe and suggest an explanation for the variation in thickness of the conglomerates (**cg**) within the Auchtitench Formation (**AUC**), north of the Southern Upland Fault. [2]

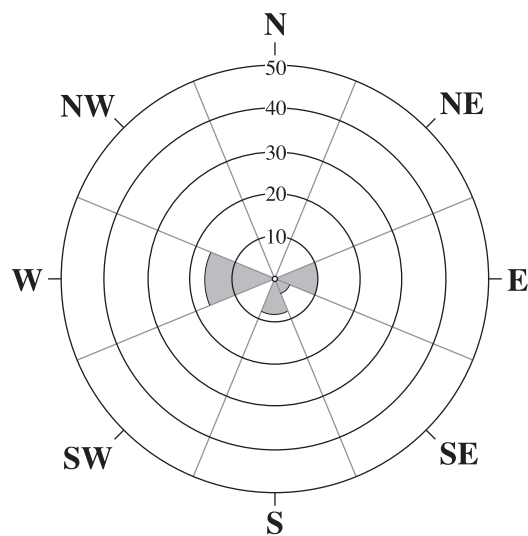
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- (b) **Table 6** shows the result of an analysis of 144 pebble orientations typical of the Auchtitench conglomerates (**cg**). **Figure 6b** is a partly completed rose diagram of palaeocurrent directions associated with these data.

Direction	N	NE	E	SE	S	SW	W	NW
Total pebbles	48	25	10	3	8	0	15	35

Table 6**Figure 6b**

- (i) Complete the rose diagram (**Figure 6b**) to show the palaeocurrent directions typical of this conglomerate. [3]
- (ii) Describe the variations in palaeocurrent directions shown by the completed **Figure 6b**. [2]
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- (iii) **Figure 6a** represents the most typical palaeocurrent direction. Estimate the probable direction in which the camera (**Figure 6a**) was pointed. [1]
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- (c) Explain how the Southern Upland Fault may have influenced palaeocurrent directions during the deposition of Siluro-Devonian sediments. [2]
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Total 13 marks**Turn over.**

7. **Figure 7** is part of the **Geological Map** (Box A) showing the boundaries of the existing Glenmuckloch Opencast Coal site. Two extensions to this pit were proposed in 2007 for opencast development: the Samsiston and Knowe sites.

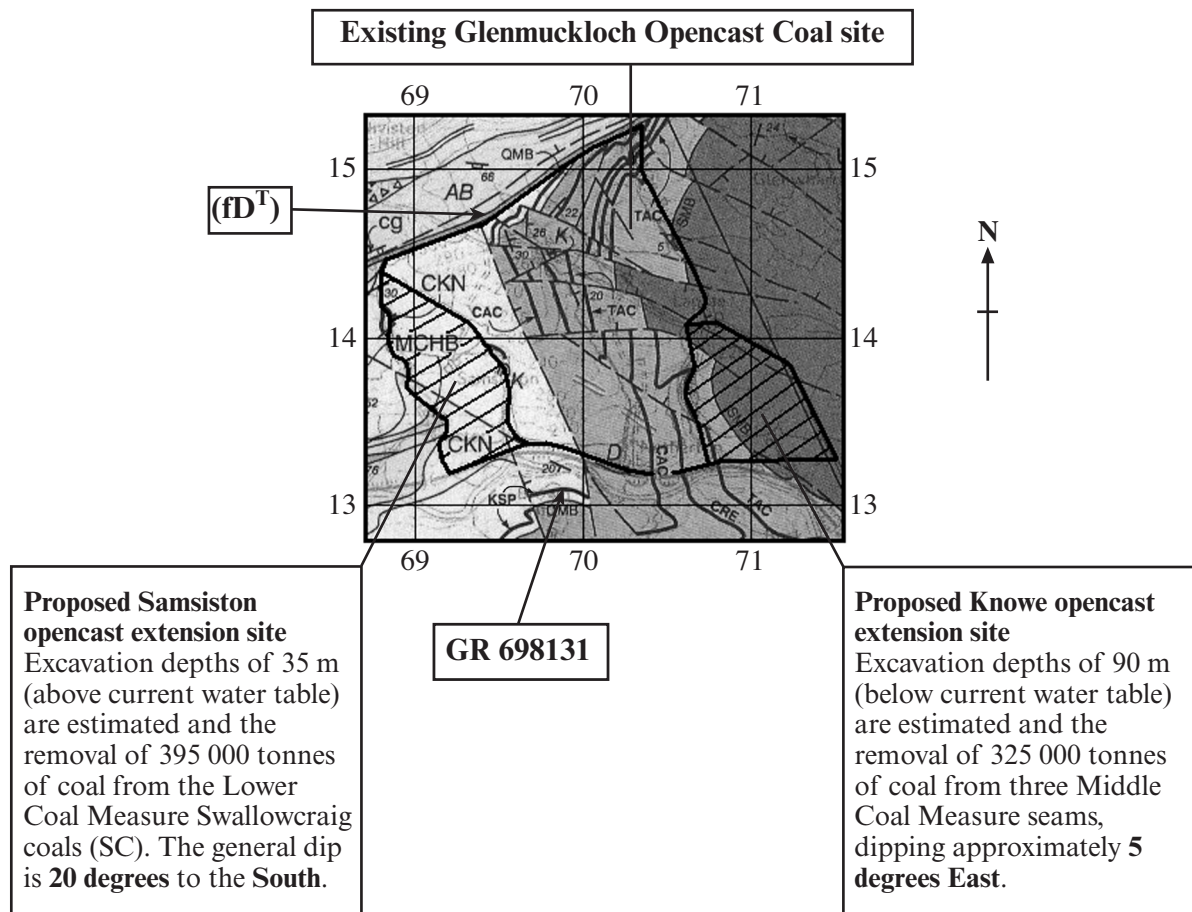


Figure 7

Refer to the **Geological Map**, **Figure 7** and **generalised Geological Column**.

- (a) State the rock type (**fD^T**) and name the geological feature that controls the northern boundary of the Glenmuckloch Opencast site. [2]

Rock type (fD^T)	Geological feature
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- (b) (i) Complete **Table 7** below to indicate the order of superposition of the three coals first encountered during the proposed mining operations beneath the **Knowe site**. [2]


Dip direction	Average angle of dip (degrees)	Name of coal seam	Relative age of coal seam
East	5 degrees	•	youngest
		•	
		•	
			oldest

Table 7

- (ii) The **generalised Geological Column** shows three coal seams within the Lower Coal Measures (LCMS). Explain why the **Kirkconnel Splint coal (KSP)**, as seen at **GR 698131**, would **not** be expected beneath the **Samsiston site**. [2]

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- (iii) Suggest **two geological** factors that may affect the accuracy of coal reserve estimates and excavation depths beneath the two proposed sites. [2]

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- (c) Using the information given and your knowledge, identify the possible environmental issues associated with the further extraction of coal resources from the Glenmuckloch Opencast site. [6]

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Total 14 marks