

Geology 12
 August 2006 — Form A
 Provincial Examination — Answer Key

Cognitive Processes

K = Knowledge
U = Understanding
H = Higher Mental Processes

Question Type

70 = Multiple Choice (MC)
10 = Written Response (WR)

Topics	Prescribed Learning Outcomes (PLOs)	Weightings
1. Earth Materials	A, B, C, D, E, F	30%
2. Time and Fossil Record	G, H, I, J	20%
3. Internal Processes and Structures	K, L, M, N, O	30%
4. Surficial Processes	P, Q, R, S	15%
5. Comparative Planetology	T	5%

Question Number	Keyed Response	Cognitive Process	Mark	Topic	PLO	Question Type
1.	D	K	1	1	A4	MC
2.	B	U	1	1	C2	MC
3.	B	K	1	1	B1	MC
4.	D	U	1	1	B2	MC
5.	B	U	1	1	B2	MC
6.	C	H	1	1	B3	MC
7.	A	U	1	4	P2	MC
8.	C	H	1	4	P2	MC
9.	D	U	1	4	Q1	MC
10.	B	U	1	1	D3	MC
11.	A	U	1	4	D4	MC
12.	C	U	1	4	Q4	MC
13.	B	H	1	1	A5	MC
14.	D	H	1	1	D2	MC
15.	B	U	1	4	Q3	MC
16.	C	K	1	1	D4	MC
17.	D	U	1	1	E1	MC
18.	C	K	1	1	E3	MC
19.	D	K	1	1	F3	MC
20.	C	K	1	1	F3	MC
21.	D	U	1	1	F1	MC
22.	B	H	1	1	F7	MC
23.	D	U	1	1	F8	MC
24.	D	U	1	2	G5	MC
25.	C	U	1	2	I2	MC
26.	B	H	1	2	H2	MC
27.	B	K	1	2	J5	MC
28.	B	U	1	2	J4	MC

Question Number	Keyed Response	Cognitive Process	Mark	Topic	PLO	Question Type
29.	B	U	1	2	J6	MC
30.	B	H	1	2	G3	MC
31.	C	U	1	2	G5	MC
32.	D	U	1	2	G4	MC
33.	D	U	1	2	G2	MC
34.	A	U	1	2	H4	MC
35.	B	U	1	2	J3	MC
36.	A	U	1	2	J2	MC
37.	C	H	1	2	J5	MC
38.	B	U	1	2	G2	MC
39.	A	U	1	2	J7	MC
40.	C	K	1	2	J7	MC
41.	A	K	1	3	K6	MC
42.	D	K	1	1	C6	MC
43.	A	U	1	1	C7	MC
44.	A	U	1	1	C4	MC
45.	C	H	1	3	K2	MC
46.	C	U	1	3	K3	MC
47.	A	U	1	3	K2	MC
48.	D	U	1	3	K7	MC
49.	D	U	1	3	K5	MC
50.	B	U	1	3	K6	MC
51.	A	U	1	3	L1	MC
52.	D	U	1	3	L5	MC
53.	D	H	1	3	L4	MC
54.	C	U	1	3	N1	MC
55.	B	H	1	3	O1	MC
56.	A	U	1	3	L5	MC
57.	C	U	1	3	O3	MC
58.	B	H	1	3	O5	MC
59.	B	U	1	3	O4	MC
60.	C	U	1	3	O4	MC
61.	C	U	1	3	O7	MC
62.	A	H	1	3	O6	MC
63.	B	K	1	4	R1	MC
64.	A	U	1	4	R2	MC
65.	C	U	1	4	Q4	MC
66.	B	U	1	4	S2	MC
67.	A	U	1	5	T1	MC
68.	D	U	1	5	T3	MC
69.	A	U	1	5	T2	MC
70.	B	U	1	5	T4	MC

Geology 12

August 2006

Provincial Examination — Written-Response Key / Scoring Guide

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Question Number	Keyed Response	Cognitive Process	Mark	Topic	PLO	Question Type
1.	–	U	3	1	A6, A7	WR
2.	–	U	2	1	C8, C7	WR
3.	–	U	4	1	F5, F7	WR
4.	–	U	3	2	H1, H3	WR
5.	–	U	4	3	K1, K4	WR
6.	–	U	4	3	N1, N2, N3	WR
7.	–	H	3	3	O7, O6, O9	WR
8.	–	U	2	4	P5	WR
9.	–	U	2	4	R1, R2	WR
10.	–	U	3	4	S1, S2, S4	WR

PART B: WRITTEN RESPONSE

Value: 30 marks

Suggested Time: 40 minutes

INSTRUCTIONS: Answer the following questions in the space provided in the **Response Booklet**.
You may not need to use all of the space given.

1. Sediment is being deposited in the centre of a lake in BC at the current rate of 1 mm/year. A drill hole in the centre of the lake reveals that the thickness of sediment is 11 m.
(Note: 1 m = 1000 mm).

a) How long has the sediment been accumulating in the lake? Show all calculations. **(2 marks)**

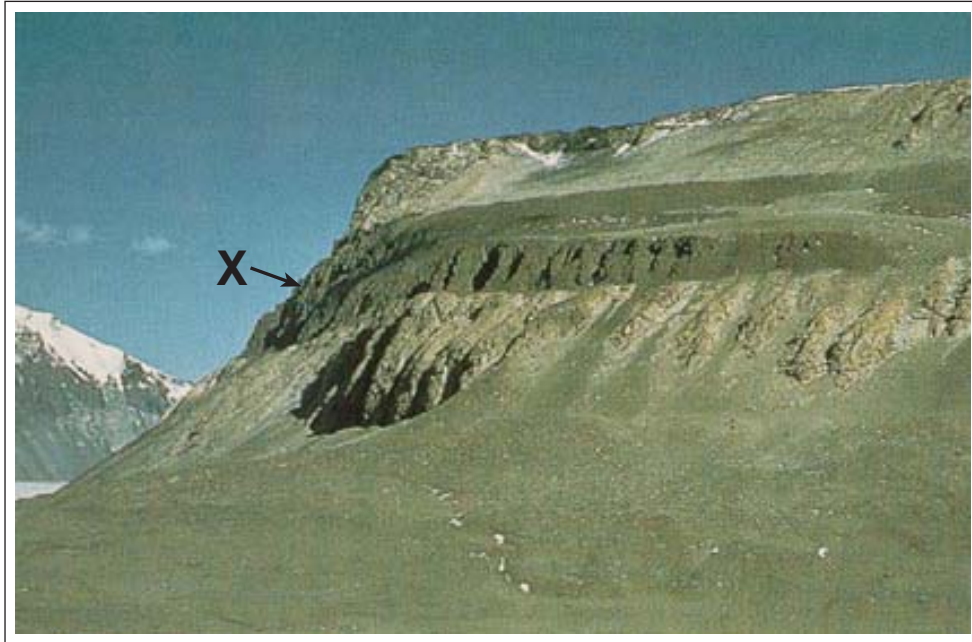
$$\begin{aligned}\text{Time} &= \text{depth}/\text{rate} = 11\,000 \text{ mm}/1 \text{ mm/year} \\ &= 11\,000 \text{ years}\end{aligned}$$

b) Describe a geological assumption you made in order to perform this calculation. **(1 mark)**

Any one for 1 mark:

- that sediment is building up at the same rate every year
- that sediment was deposited every year
- that sediment was not removed

Use the following photograph of an igneous layer to answer question 2.



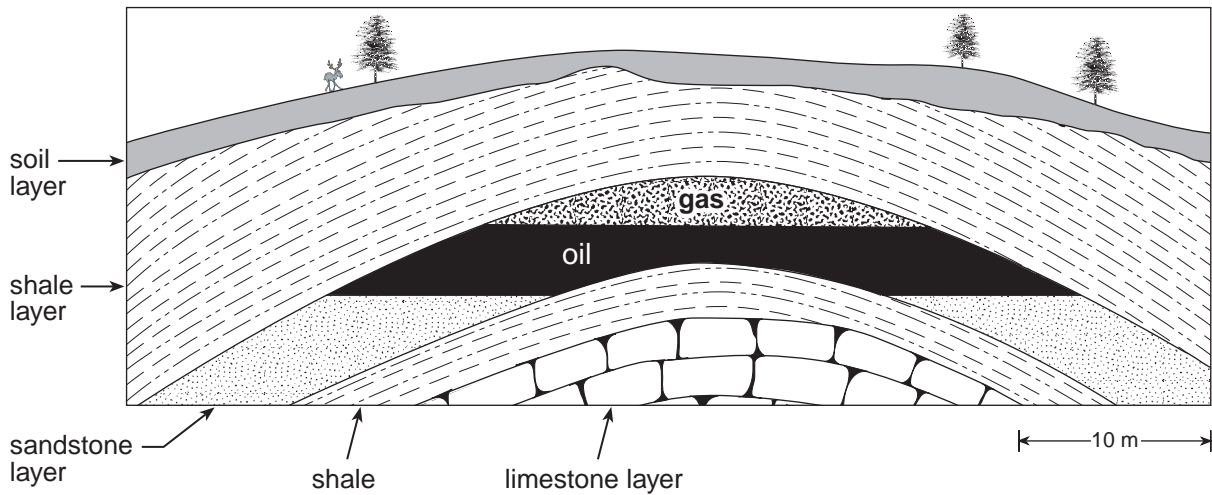
© GSC

2. Describe **two** pieces of evidence that could be found in or near the dark igneous layer at **X** to establish that it was a sill, and not a buried lava flow. **(2 marks)**

Any two for 1 mark each:

- **inclusions on top and bottom of feature in a sill, but only on bottom of lava flow**
- **no sign of weathering on top of feature in a sill**
- **contact metamorphism of country rock above and below feature**
- **a sill would have a lack of vesicles**
- **a sill would have a lack of pahoehoe and aa textures**

Use the following diagram of an oil and gas deposit to answer question 3.



3. a) Describe how the oil and gas might have formed.

(2 marks)

Any one for 2 marks:

- marine microorganisms in oceans die
- marine microorganisms get buried
- chemical reactions cause creation of hydrocarbons
- hydrocarbons accumulate in traps

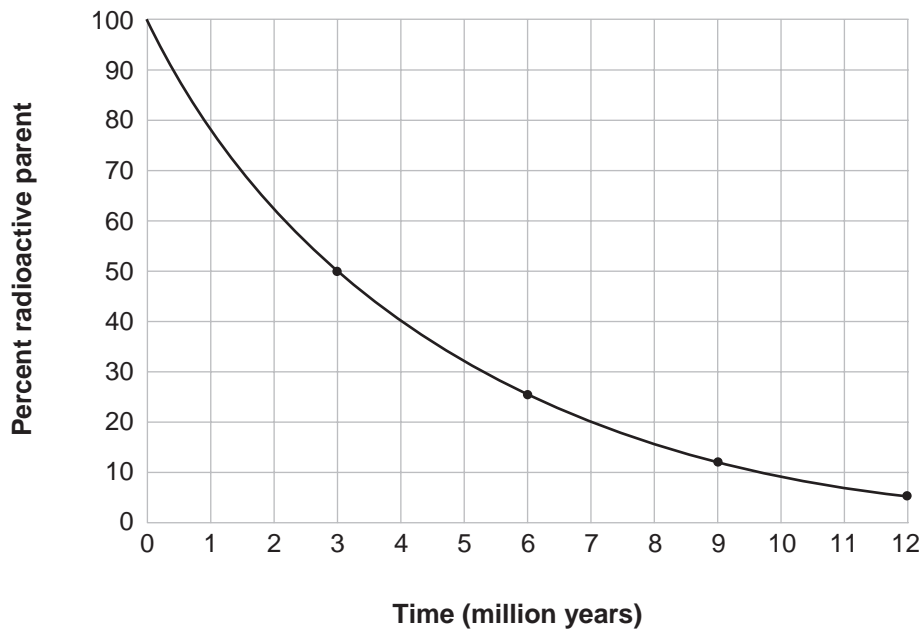
b) Describe **two** characteristics of the rock materials that enable the oil and gas to accumulate in this particular location.

(2 marks)

Any two for 1 mark each:

- the reservoir rock must be porous
- the cap rock must be impermeable
- the reservoir must be permeable
- appropriate structure (anticline)

4. a) On the grid below, sketch a radioactive decay curve for an element with a half-life of 3 million years. Your sketch must contain a smooth and clearly drawn decay curve for four half-lives. **(2 marks)**



Point (3 million years, 50%) ← 1 mark

Shape of curve for four half-lives ← 1 mark

- b) Describe **one** problem associated with radiometric dating of a sedimentary conglomerate that has been heavily weathered. **(1 mark)**

Any one for 1 mark:

- a conglomerate may contain several types of rock, each with its own age
- dating of a sedimentary rock will generally just give the age of the constituent rocks
- weathering may have removed or added parent or daughter elements thus producing erroneous dates
- cannot usually date sedimentary rocks because they often do not contain radioactive elements

5. The father of the Continental Drift Theory, Alfred Wegener, was a weather scientist. His curiosity about the possibility of moving continents arose from his study of paleoclimatology (the study of ancient climates).

- a) Describe **one** piece of evidence relating climate to ancient glaciation that could be used as evidence to prove his Continental Drift Theory. **(1 mark)**

Any one for 1 mark:

- **glacial artifacts found in areas that are now tropical**
- **glacial deposits found in areas that are now tropical**
- **glacial striations originating from a common ancient source**

- b) Describe **one** piece of evidence relating climate to plants or animals that could be used as evidence to prove his Continental Drift Theory. **(1 mark)**

Any one for 1 mark:

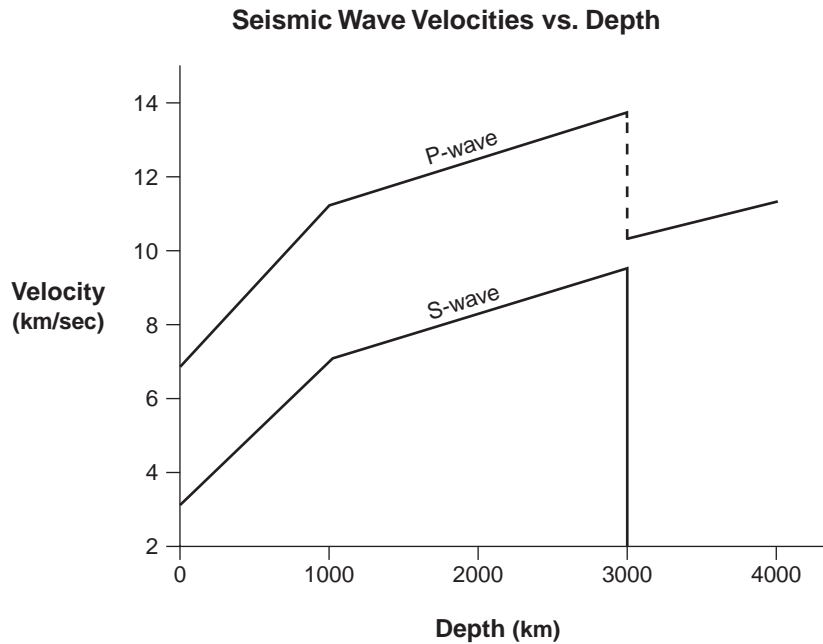
- **fossils of animals found in areas that could not support them now**
- **fossils of tropical plants found in areas that are too cold to support them now**
- **coal deposits (remnants of tropical swamp environment) found in areas that are too cold for them to form today**

- c) Wegener's theory could not explain how the continents actually moved. Describe how geologists today explain how continents move. **(2 marks)**

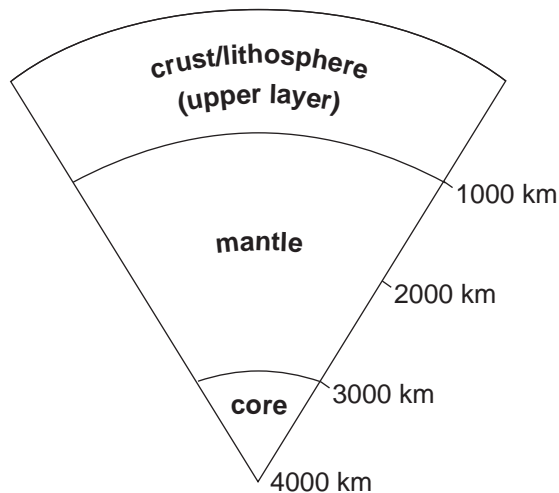
- **continents are on moving plates ← 1 mark**
- **plates move due to convection currents in the mantle, therefore continents move along with plates } ← 1 mark**

Note: Current theory suggests that slippage may play a major role in plate movement.

Use the following Seismic Wave Velocity Chart to answer question 6.



6. Imagine a new planet has been discovered. A probe that landed on the planet monitored seismic activity, and computers generated the seismic wave velocity chart shown above.
- a) Complete the cross section of the planet's interior based on the seismic information. Label the cross section with terms consistent with those used to describe the Earth's interior. **(2 marks)**



b) Describe **two** ways in which the interior of this planet is different from that of Earth.

(2 marks)

Any two for 1 mark each:

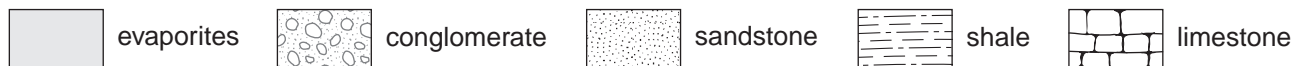
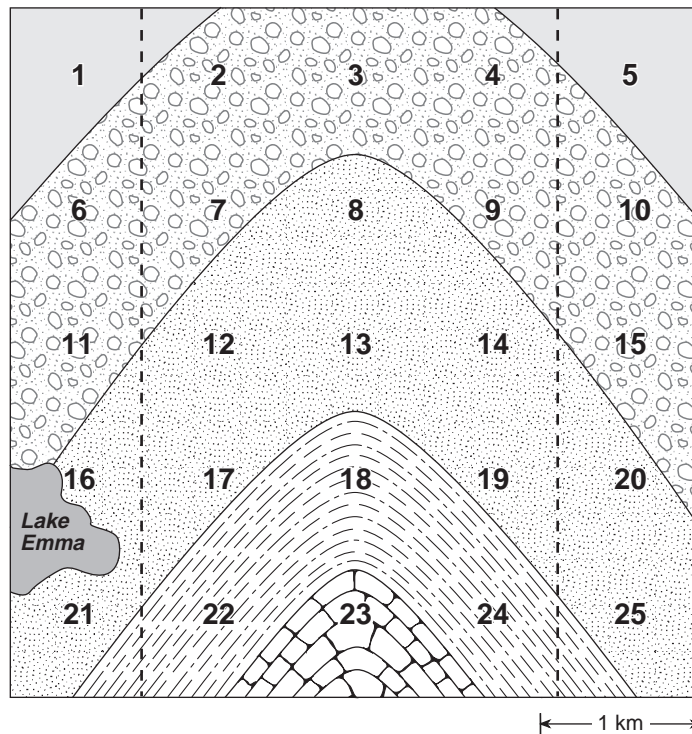
- **crust is thicker**
- **liquid core is smaller**
- **core is liquid**
- **no low velocity zone**
- **no solid inner core**

7. A geologist has systematically collected samples from the 25 locations shown on the map below. She has plotted some of the rock-type data on the map.

Table of Rock Type	Locality
evaporites	1, 5
conglomerate	2, 3, 4, 6, 7, 9, 10, 11, 15
sandstone	8, 12, 13, 14, 16, 17, 19, 20, 21, 25
shale	18, 22, 24
limestone	23

a) Complete the map to show the geological structure.

(2 marks)



1 mark for symmetric structure

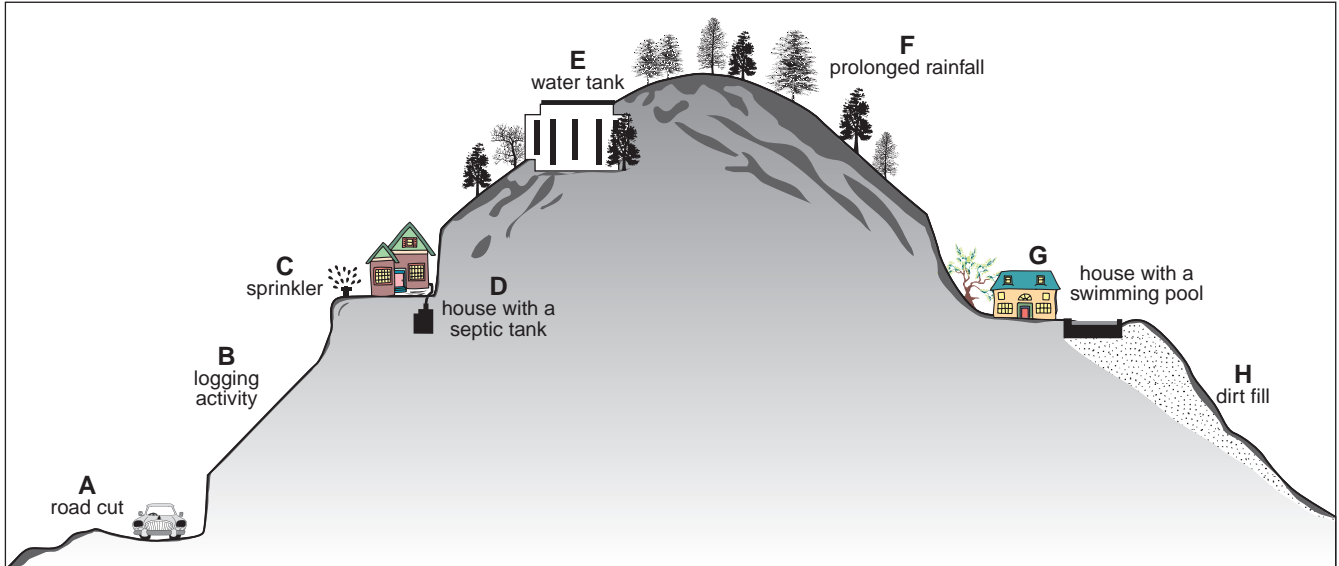
1 mark for completing contacts

b) Describe how a geologist would determine whether the structure was an anticline or a syncline. **(1 mark)**

Either one for 1 mark:

- **syncline: dips are inward**
- **youngest rocks would be in the bottom middle**

Use the following diagram to answer question 8.



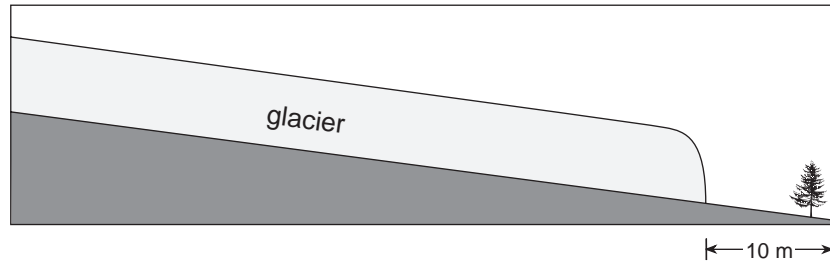
8. The diagram shows a variety of problem situations that could create a geological hazard. Pick **two** problem situations and give a geological solution for each. **(2 marks)**

Any two for 1 mark each:

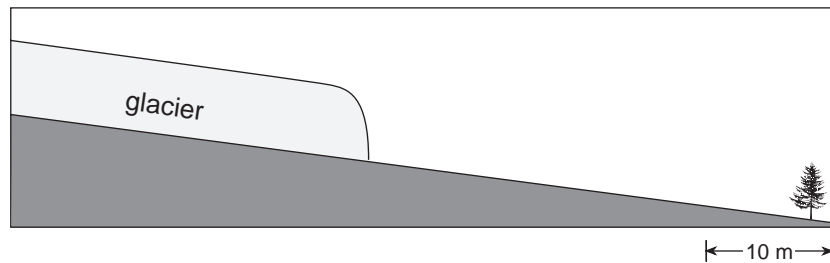
Problem	Solution
A (road cut too steep)	build retaining wall, remove material above road, move road further away from cut and reduce slope angle
B (logging activity)	add vegetation, improve drainage, reinforce slope
C (sprinkler)	do not use sprinkler except in very dry weather – too much water in the soil adds to its weight, or improve drainage in soil being sprinkled
D (house with septic tank)	provide good drainage for the septic field associated with the septic tank so that water does not remain in the slope, adding to its weight
E (water tank)	remove tank, check that water is not leaking from the tank
F (prolonged rainfall)	provide adequate drainage
G (house with pool)	check that pool does not leak, remove pool, shore up base of fill slope below pool
H (dirt fill)	shore up base of fill slope below pool, or remove pool and fill

Use the following diagrams to answer question 9.

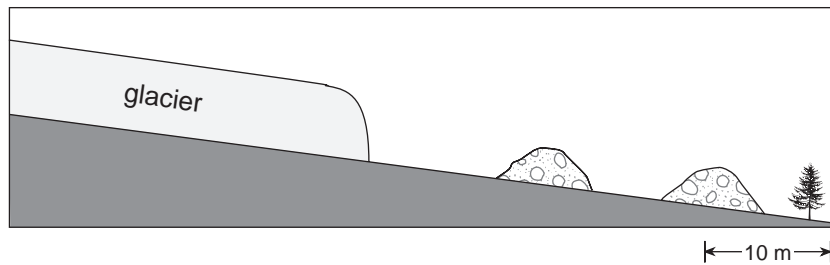
August 2004



August 2006



9. Helm Glacier on Mt. Garibaldi has been retreating since the summer of 2004, and leaving a recessional moraine every winter. On the August 2006 diagram above, draw and label (with date) recessional moraines that would likely have formed during the winters of 2004-2005 and 2005-2006. **(2 marks)**



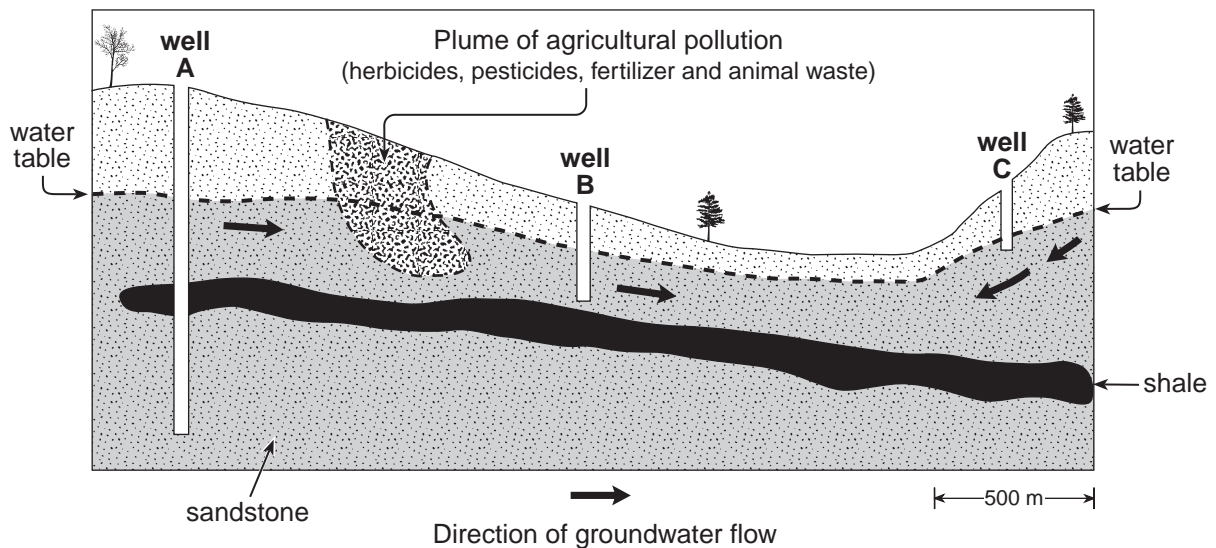
For 2 marks:

Appropriate shape for recessional (end) moraines

Moraines separated from toe of glacier

2004-2005 moraine further downslope than 2005-2006 moraines

Use the following cross section showing groundwater flow, three water wells and a pollution plume to answer question 10.



10. a) Name the zone immediately above the water table and describe how it is different from the zone immediately below the water table. **(1 mark)**

Either one for 1 mark:

Name: **Zone of aeration (or vadose zone)**

Description: **This zone contains groundwater, which is flowing down to the water table, but the zone is not completely saturated.**

Name: **Capillary fringe (zone of intermittent saturation)**

Description: **Holds water only during the wet season**

- b) Choose **one** of the wells, A, B or C, and give **two** reasons why it is likely to produce an abundant, long-term supply of pure drinking water. **(2 marks)**

Well chosen: **A**

Reason 1: **Well A is deep and has access to large volumes of water**

Reason 2: **Well A is isolated somewhat from the pollution plume by the impermeable clay layer.**

Would not choose well C because it is too shallow.

Would not choose well B because the pollution plume will eventually reach it.

END OF KEY