



15th International Geography Olympiad

Québec City, Canada

31 July – 6 August, 2018

Written Response Test Marking Scheme

Instructions for Markers

1. **Check if the iGeo student numbers are on each sheet (on odd pages) before dividing up the Test.**
2. This test consists of 6 Sections.
3. The maximum total mark is 90.
The mark for each question is given in the margin at the beginning of the question.
There is a maximum of 15 marks for each Section.
4. One whole Section per pair of markers.
5. Get the hang of the full range of answers by reading through a few papers with your co-marker before you start your marking.
You can mark together (especially for level marking), or after establishing a consensus on how to mark for thoroughness and consistency, act as each other's double-checkers by marking half of the test and then swapping the pile.
We strongly recommend whenever in doubt, consult your marking partner and, if appropriate, one of the designated Moderators – Dubravka or Mark.
6. Please develop your own marking/correcting notation system (using +/-, x/0, $\sqrt{\quad}$ marks), underlining, comments etc. to ease double-checking and sample marking.
7. **These answers here are not exhaustive. Credit any relevant answer.**
8. Check whether the answer continues outside the designated area, in the margins or as clearly marked on blank pages.
No credits will be given to answers in the Resource Booklet.
9. The Test uses two marking systems: point and level marking.
10. Half marks can only be given where indicated as the total of 90 marks will yield only 40% of the total Olympiad result.
11. Mark only the required number of answers (reasons, examples etc.).
For instance, if the question asks for 2 reasons and there is more than 2, only the first 2 reasons should be marked.
12. Put your final mark next to the question number in the column on the left – it eases the work of the person who has to put the numbers into MS Excel.
Please write your numbers clearly.
13. Please write down any inconsistencies of the Marking Scheme, revisions and additional answers or answers not accepted on the Notes page at the end of the Booklet (e-mail is preferred) and hand them in after marking to improve the final Marking Scheme that will be uploaded to show the actual marking.
14. The Moderators (Dubravka and Mark) will sample the marking of all teams.

Command Terms for use in Written Response Test

Terms	Meaning
Compare	identify the points of similarity and difference between two or more things (two sets of descriptions are not a comparison)
Contrast	identify clearly the points of difference
Define	State precisely/accurately what a word means
Describe	give a factual statement of the distinctive features of something, e.g. for a landform, its shape, dimensions, composition, location (do not explain)
Discuss	give a thorough account from different points of view
Draw	make a clearly defined diagram, flowchart or map, and include labels
Evaluate	consider several arguments or options and come to a conclusion about their importance or success
Explain	give a reason, a cause, an effect, a consequence for why or how something happens
Identify	name, select, point out something
Name	state or specify, using a word or words by which something is known
Outline	give the main points or general principles of something, omitting minor details, and usually emphasizing structure and relationships

In level marking in order to credit higher marks the response has to cover a multi-perspective view with a range of factors/impacts from different spatial and temporal scales forming a thorough and well-elaborated account.

Written Response Test

Contributions from: Australia, New Zealand, Poland and Thailand

Committee Convenor: Margaret McIvor (Australia)

Deputy: Dubravka Spevec (Croatia)

Editors: Birgit Sandermann Justesen (Denmark), Ivan Sulc (Croatia), Li Ling Tan (Singapore)

Reviewers: Mark Higginbottom (UK) and Anu Printsmann (Estonia)

Director of Tests: Su-Min Shen (Taiwan/China-Taipei)

Section A: Population

2 m

1. Study Resource Booklet Figure A1: Population growth, 2015.

Outline why the highest population growth is found in countries like Mali, Chad, and Democratic Republic of the Congo.

Answer (point marking – 0.5 marks for each correct point):

These countries are some of the poorest in the world

- A lack of medical facilities leads to a high infant mortality so parents tend to have more children in hope that several will survive
- Population is less educated (especially female), they finish school earlier and establish family with more children
- The lack of proper sexual education (particularly for women) – little if any knowledge about birth control or family planning
- No money for family planning because of limited family income
- Subsistence economy – many children are needed to work on the land
- Low life expectancy – children are required to look after parents
- Some religious beliefs encourage large families
- Few doctors, hospitals and medicine
- Marriage at early age
- Culture (tradition) of big families with lot of children
- Development of medical care significantly reduced death rate (especially of children at birth)

4 m

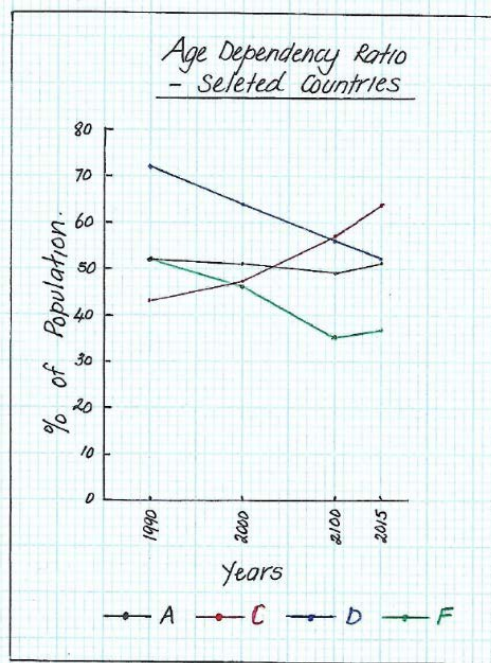
2. Study Resource Booklet Table A1: Population data – selected years.

(a) Draw a graph which shows the **Age Dependency Ratio** for Countries A, C, D and F.

Answer (point marking):

- 0.5 marks each for correct title, correct labelling of the horizontal axis, correct labelling of the vertical axis (with appropriate scale), a key. (2 marks)
(Note - the horizontal axis will need to show a five-year interval for the period 2010 to 2015)
- 0.5 marks for each line drawn correctly. (2 marks)

(Note – a line graph is the most suitable graph to the information required. If you think that an alternative graph is appropriate, mark it accordingly. Otherwise, only give marks to aspects that are correct.)



2 m

(b) Describe the **trends** shown in the graph.

Answer (point marking – 0.5 marks for each correct way):

- Countries D and F demonstrate a similar trend (0.5 marks) as both have experienced a significant decreasing age dependency ratio (0.5 marks)

(Note – instead of the point above, students may say

- Country D's age dependency ratio had a steady decrease from 72% in 1990 to 52% in 2015.
- Country F's age dependency ratio decreased from 52% in 1990 to 35% in 2010 but then it increased between 2010 and 2015 to 37% (.0.5 marks)
- The age dependency ratio for Country A has remained relatively constant averaging 50% - with only slight fluctuations (0.5 marks)
- Country C has experienced a significant increase in the age dependency ratio from 43% in 1990 to 64% in 2015.

2 m

3. Study Resource Booklet Table A1: Population data – selected years.
Identify the country which is likely to be **least developed** and explain why.

Answer (point marking – 0.5 marks for each correct reason):

This answer requires students to show the connections between the statistics and characteristics of less developed countries.

- **Country D** (0.5 marks)
- Although the **increase in the GDP** from \$375 to \$1598 per capita was probably responsible for some advances in the standard of living, it was the smallest increase and significantly lower than the other countries.

- The **crude birth rate** has decreased from 31 to 20 per 1,000 people – but this is still significantly higher than the other countries and typical of less developed countries.
- Overall, the **age dependency ratio** has decreased from 72 to 52, but as the % aged 65 and above has only increased from 4% to 6%, **46% of the population is aged less than 15 years.**
- Thus, Country D is typical of a less developed country with a low GDP per capita resulting in a large % of the population less than 15 years (indicating a high birth rate due to poor education, poverty etc) and a very low percentage 65 years or above (indicating a low life expectancy due to inadequate health services) etc.

2 m

4. Study Resource Booklet Table A1: Population data – selected years.
Identify the country which is likely to be experiencing **economic growth** and explain why.

Answer (point marking – 0.5 marks for each correct reason):

This answer requires students to analyse the statistics and show the connections between them and their own information about countries that are developing.

(i.e. This would require students to explain that GDP is a good indicator of economic growth. Gross Domestic product is a measure of the value of goods and services produced in an economy over a given period. It is very difficult for a country to be improving its standard of living, with improved access to health, food and education etc, if it is not achieving economic growth.)

- **Country F** (0.5 marks) has had a massive **increase in GDP** from \$US 318 per capita to \$US 8,028. This would have enabled **better health and education facilities**, as shown by the **birth rate almost halving** (from 21 to 12 births per 1,000 people) and the **decrease in the % of the population less than 15 years** (from 47% to 27%)
- A better standard of living also means a decrease in the death rate and an increase in life expectancy, which is shown by the **increase in the % living beyond 65 years** from 5% to 10%.

3 m

5. Outline 3 possible impacts that an **ageing society** may have on a country's economic development.

Answer (point marking – 1 mark for each correct impact):

- A country will have higher expenditure for health care services of the elderly resulting in less money in the budget for economic development.
- If that particular country has lower birth rate that would lead to a smaller number of working age population, its productivity and national income will be decreasing; necessity for labor force import.
- A country will have to increase its tax rates for the working age groups to cover the expenses for the elderly. Therefore, the workforce will have to work harder with a smaller net income. Such shrinking income will inevitably lead to lower purchase power (living standard) and the financial system will become stagnant or it will become burden for workers.
- Older people can teach younger to improve their skills and knowledge.
- People work longer and more tax income can be generated.

Section B: Tourism: The Rise of Airbnb

Airbnb is an online community marketplace that connects people looking to rent their homes with people who are looking for accommodation.

1 m 1. Give 2 reasons why tourists may visit large cities, such as New York.

Answer (point marking – 0.5 marks for each correct reason):

- Possible examples of tourist activities
 - Visiting cultural monuments (e.g. St. Patrick's Cathedral)
 - Observing specific urban landscape (e.g. Mid-Manhattan, Financial District)
 - Visiting skyscrapers (including rooftop panoramas; e.g. Empire State Building, Rockefeller Center, World Trade Center One)
 - Visiting public areas (e.g. Times Square, Central Park, Fifth Avenue, the Financial District)
 - Visiting museums (e.g. MoMa, Museum of Natural History, Guggenheim Museum)
 - Visiting Ellis Island and the Statue of Liberty
 - Taking cruises along the Hudson River and the New York Bay
 - Attend Broadway theatre productions
 - Participate in cultural events (Tribeca Film Festival, free performances in Central Park at Summerstage and Delacorte Theater)
 - Visit ethnic enclaves (e.g. Little Italy, China Town, Harlem)
 - Tasting ethnic food in ethnic restaurants and bars (e.g. Little Italy, China Town, Harlem)
 - Participate in sports events (e.g. New York Marathon, basketball games in Madison Square Garden)
 - Taking guided tour on locations of famous movies and TV shows (e.g. Seinfeld, Friends, Breakfast at Tiffany's, Miracle on 34th Street, Godfather)
 - Visiting memorial site of the 9/11
 - Lifestyle

Accept any other relevant and correct answer. For example,

- for leisure, business...as long as consistency is applied.

3 m

2. Study Resource Booklet Figure B1: Five boroughs of New York City and sub-districts of Manhattan and Figure B2: Distribution of hotels and Airbnb properties throughout New York City.

Identify 2 patterns shown on the map and explain each pattern that you have given.

Answer (point marking – 0.5 mark for relevant pattern and 1 mark for valid explanation of pattern):

Pattern (0.5 mark per pattern)	Explanation (1 mark for each pattern explained. Look for a <u>reason</u> not just a description)
Hotels are predominantly clustered around the Mid-Manhattan area	Due to tourist <u>demand</u> or tourist <u>needs</u> . <u>Central</u> to NY CBD, retail, services, attractions, and hotels <u>cater</u> for tourists (on holiday or business travellers). Hotels can <u>afford</u> higher cost of <u>rent</u> in CBD whereas many residential properties cannot.
Airbnb properties are much more dispersed (spread out) over a larger area of NY	Airbnb <u>make use of private residences/apartments</u> and will be situated in <u>residential</u> areas surrounding the CBD as well as in inner city apartments
Hotels are fewer in number but have more rooms than Airbnb	Hotels are <u>specifically built for tourism</u> and tend to be high-rise with more rooms to <u>maximise profits</u> whereas Airbnb make use of <u>individual</u> residences or apartments so have fewer rooms.
Outside Manhattan Airbnb properties are concentrated mainly in Brooklyn, less in Queens and least in Bronx	Brooklyn is located near to Lower Manhattan and it is <u>well connected</u> by public transport lines, as well as parts of Queens next to Mid-Manhattan. There are also <u>certain tourist attractions</u> that tourists visit (e.g. ZOO). Brooklyn is still considered <u>safer for tourists</u> than some other areas (e.g. Bronx).
There are no hotels and Airbnb properties west of Manhattan on the map	The map shows hotels and Airbnb properties <u>only in New York City</u> that consists of 5 boroughs (Manhattan, Brooklyn, Queens, Bronx and Staten Island). Hotels and Airbnb properties in Jersey City that comprises areas <u>on the right bank of the Hudson River</u> are not showed on the map. Hence, it is a consequence of the <u>visualization</u> and <u>administrative division</u> .
Accept any other sensible geographic pattern with a plausible explanation.	

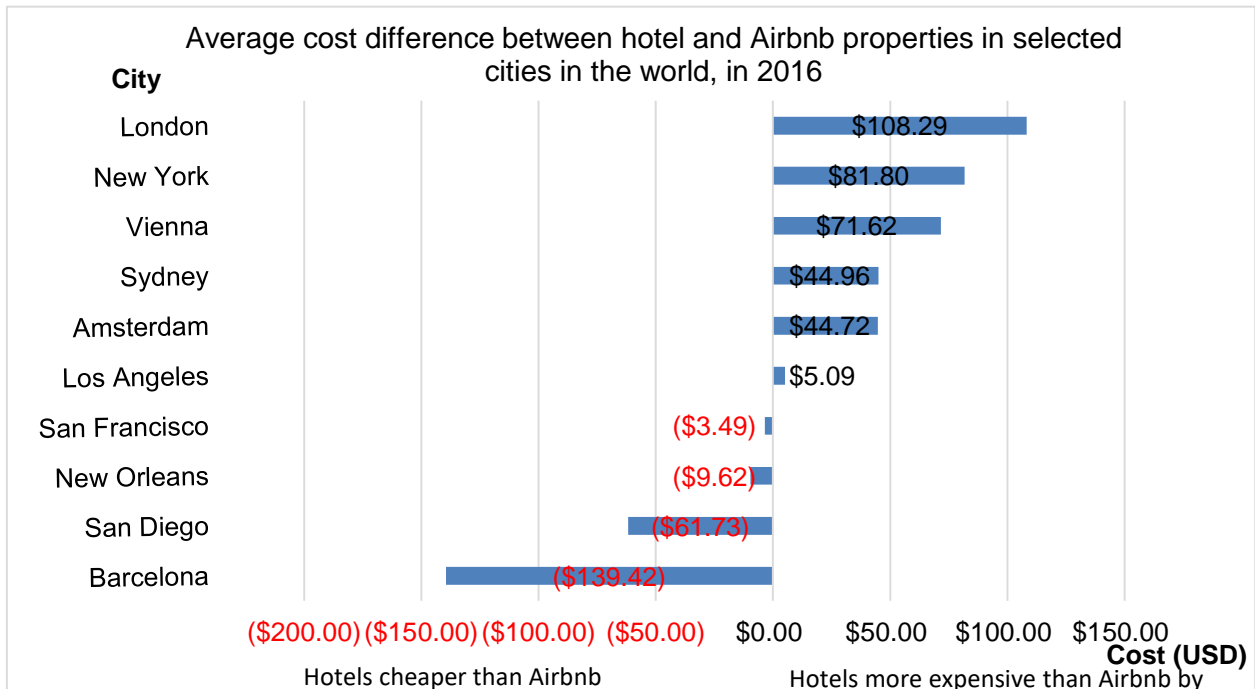
3. Study the Table below. Choose an **appropriate graphing method** to display the data in the space provided. You need to clearly show on the **same** graph how in some cities hotels are less expensive than Airbnb while in other cities hotels are more expensive than Airbnb.

Table: Average cost difference between hotel and Airbnb properties in selected cities in the world, in 2016. (in US dollars per night)

City	Hotels are less expensive than Airbnb by (USD):
Barcelona	139.42
San Diego	61.73
New Orleans	9.62
San Francisco	3.49
City	Hotels are more expensive than Airbnb by (USD):
Los Angeles	5.09
Amsterdam	44.72
Sydney	44.96
Vienna	71.62
New York	81.80
London	108.29

Source: <https://www.busbud.com/blog/airbnb-vs-hotel-rates/>

Answer (point marking – 2 marks for an appropriate diagram and 0.5 mark for each correct element of the diagram):



- **Selection of the correct graph** (1.5 mark): if they have chosen some sort of positive/negative bar or column diagram. It can be horizontal (as above) with positive and negative x-axis or vertical with positive and negative y-axis. Do not award any marks for any other type of diagram as it is not the most appropriate for the data and a key skill is for students to select the most appropriate type for the data.

- **Graphing and plotting (3.5 marks)**

If students have selected another type of graph or contracted two separate bar diagrams they may be able to score on the following marks:

- 0.5 mark for suitable **title** (must have reference to hotels and Airbnb and either one of “selected cities” (where) and/or “2016” (when)).
- 0.5 mark for the names of the cities on the **y axis** (or x axis on the column diagram). The general label “city” may be omitted. The label “city” can be above the city names or placed vertically to the left).
- 0.5 mark for the label “Cost (USD)” on the **x axis** (or y axis on the column diagram). The label can be in the same line as the amount of dollars or below.
- 0.5 mark for **even scale** on the axis with the cost value. Intervals of cost in USD have to be the same for positive and negative values.
- 0.5 mark for **expressing positive and negative values in a different way** (e.g. different colours of bars/columns for positive and negative values, different colour of values beside the bars/columns etc.).
- 1 mark for **accurate plotting** (use eyeball method to check a couple of high and low values). Allow for small amounts of rounding to suit the scale. Elements have to be appropriately ordered.

6 m

4. Study Resource Booklet Figure B3: Airbnb protest in Barcelona and the Figure below.

Figure: Some Airbnb data for Barcelona

- €1 billion in economic activity from Airbnb
- €167 million earned by local households
- 16,100 hosts
- 20,000 listings
- 27 million tourists in 2012 to more than 34 million in 2016. Over 25 % increase in four years.
- 40% of Barcelona’s tourist apartments are illegal.
- City is facing a housing problem for those who live and work here. Rents increased by 16.5% in 2016.

(<http://www.independent.co.uk/travel/news-and-advice/barcelona-locals-hate-tourists-why-reasons-spain-protests-arran-airbnb-locals-attacks-graffiti-a7883021.html>, <https://www.airbnbitizen.com/airbnb-community-generated-more-than-e1-billion-in-barcelona-in-2016/>)

Evaluate whether the introduction of Airbnb to cities like Barcelona is more positive or negative for local people. Your decision should be based on both economic and social impacts supported with/by specific evidence.

Answer (point marking – 2 marks for each identified and explained/assessed impact; maximum 2 marks):

- 1 mark for an identified social impact (positive or negative) and another mark for the explanation using data. E.g., Airbnb displaces locals from their homes and causes the rise of rents because property owners turn their apartments into Airbnb properties as they can make more money than from the rent. In 2016, rents in Barcelona rose by 16.5%, which made many properties unaffordable for locals.
- 2 marks (as above) for an identified and explained/assessed economic impact (positive

or negative). E.g., Money generated from Airbnb goes into the local economy. In Barcelona this amounts to over 1 billion Euros annually which supports many other sectors of the economy, including generating income for 16,100 hosts.

Answer (level marking – 2 marks):

- For Evaluation look for an overall judgement and a justification using some evidence for it. Judgement can be for either positive, or negative, or more positive for tourists or some citizens (e.g. property owners) than for other locals (i.e. depends on perspective).
- 2 marks for a strong judgment that has a strong justification (a balanced answer that uses several specific evidences as support). E.g. Depending on your perspective, Airbnb could be seen as either positive or negative. For locals in Barcelona, it would depend on whether they are one of 16,100 hosts making money and earning a share of 167 million euro or struggling to afford the rising rents (increased by over 16% in 2016) as property owners seek to cash in on the 34 million tourists who visit the city. Tourists benefit from the wide range of accommodation available including hotels that are less expensive than Airbnb properties (139 USD on average). While rents have risen, with careful regulation from local authorities, this issue could be diminished and so, overall, the introduction of Airbnb should be viewed as positive.
- 1 mark for judgement and weak justification (limited specific evidence). E.g., Airbnb is positive overall because the economic benefits (1 billion euro into economy) outweigh the negative social impacts of rent rises. Some of the money could be put into providing more social housing.

Section C: Environmental Geography: Coral reefs

2 m 1. Study Resource Booklet Figure C1: Location of coral reefs.

Describe the global pattern for the location of coral reefs.

Answer (point marking – 0.5 marks for each correct pattern):

- Peripheral / Around the edges of continents and islands
- Between the Tropics of Cancer and Capricorn
- 23.5 degrees north and south of the equator
- Tropical equatorial seas / western margins
- Current heat

3 m 2. Explain why coral reefs are considered to be of great value.

Answer (point marking – 0.5 marks for each correct pattern):

- They provide shoreline protection from storms / tsunamis and wave erosion
- Education and research
- Tourism income – diving / boat tours
- Fishing
- Medicine source
- Habitat for marine species; biodiversity
- Purifying water / water filtration
- Forming of islands
- Producing O₂

3 m 3. Study Resource Booklet Figure C2: Threats to coral reefs.

(a) Outline the major types of threats to coral reefs in 3 different regions of the world.

Answer (point marking – 0.5 marks for each different region and 0.5 marks for relevant threats in that region):

- South-East Asia – poison and dynamite fishing- Overfishing and damaging fishing methods
- Caribbean and Gulf of Mexico – pollution – from pesticides, insecticides and oil spills etc.
- Coast of Queensland/ Australia – pollution and sedimentation- sediments (due to erosion runoff from clearing and/or farming methods) from river leach into the sea and upset the balance of the ecosystem

2 m (b) Tourism is often regarded as a major threat to coral reefs. Identify 4 ways in which tourists cause damage to reefs.

Answer (point marking – 0.5 marks for each correct point):

- Direct contact – walking, touching, kicking, standing
- Boat anchors and/or boats being grounded
- Divers and snorkelers kicking up sediment dangerous to reefs
- Oil and paint pollution from marinas
- Release of grey water and human waste from cruise vessels
- Inappropriate fishing techniques
- Taking pieces of coral for souvenirs

2 m

4. Study Resource Booklet Figure C3: Photographs showing change in a coral reef. What name is given to the change shown in the photographs and why does it occur?

Answer (point marking – 0.5 marks for correct name, 1.5 for correct explanation):

- coral bleaching / coral whitening (0.5 marks)
 - Warmer water temperatures can result in coral bleaching. When water is too warm, corals will expel the algae (zooxanthellae) living in their tissues causing the coral to turn completely white. This is called coral bleaching. When a coral bleaches, it is not dead. Corals can survive a bleaching event, but they are under more stress and are subject to mortality.
- OR
- The main cause of coral bleaching is heat stress resulting from high sea temperatures. Temperature increases of only one degree Celsius for only four weeks can trigger bleaching events.
 - If these temperatures persist for longer periods (eight weeks or more) corals begin to die. High water temperatures can affect reefs at regional and global scale.
 - Other stressors can also cause bleaching, including freshwater inundation (low salinity) and poor water quality from sediment or pollutant run-off
 - Ocean acidification due to higher level of CO₂

1 m

5. Nature can also be responsible for damage to coral reefs. Describe a natural threat to coral reefs.

Answer (point marking – 0.5 marks for a threat and 0.5 marks for the associated aspect):

- Cyclones (hurricanes, typhoons) can break up coral reefs and erode beach / coral ecosystems - caused by the tidal surges / large waves.
- OR
- Tsunamis can break up coral reefs and erode beach / coral ecosystems - caused by the large waves.
 - El Niño heating up (heat stress event).
 - Submarine earthquakes.
 - Acid rains.
 - River sediments.

2 m

6. Study Resource Booklet Figure C4: Marine Protected Areas. Some areas of the ocean have been declared Marine Protected Areas (MPA). Outline the problems associated with the management (administering and enforcing) of MPAs.

Answer (point marking – 0.5 marks for each correct point):

- The areas are large and often difficult to patrol
- Requires international cooperation and agreements
- Expensive to maintain and patrol – difficult for less developed countries
- Livelihood for some fisherman – difficult to educate about the need to protect these areas.

Section D: River Catchments

1 m

1. Define the term **river catchment**.

Answer (point marking – 0.5 marks for each correct point):

- A catchment is an area of land / territory / region (0.5 marks) drained by one system of streams or rivers (0.5 marks).

OR

- A catchment can be defined as any area of land (0.5 marks) drained by a stream/river, or a stream/river system (0.5 marks).

(Note: The term “drainage basin” or “river basin” is often used instead of catchment.)

1.5 m

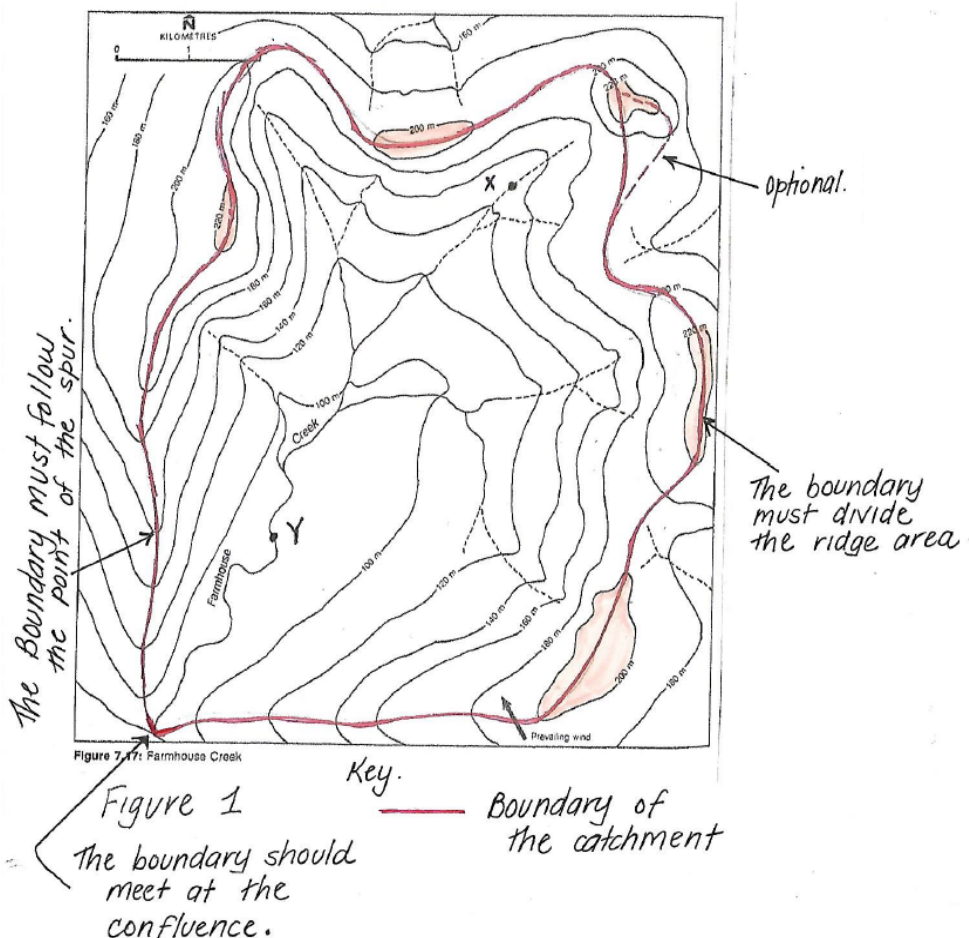
2. Study the Figure below.

(a) On the diagram, draw a line to clearly identify the **boundary** of the Farmhouse Creek catchment.

Answer (point marking – 0.5 marks for each correct point):

OR 1.5 marks if correct with minus 0.5 marks for each obvious mistake

- The boundary must follow the point of the spur
- The boundary should meet at the confluence.
- The boundary must divide the ridge area



0.5 m (b) What name is given to this **boundary**?

Answer (point marking – 0.5 marks for the correct point):

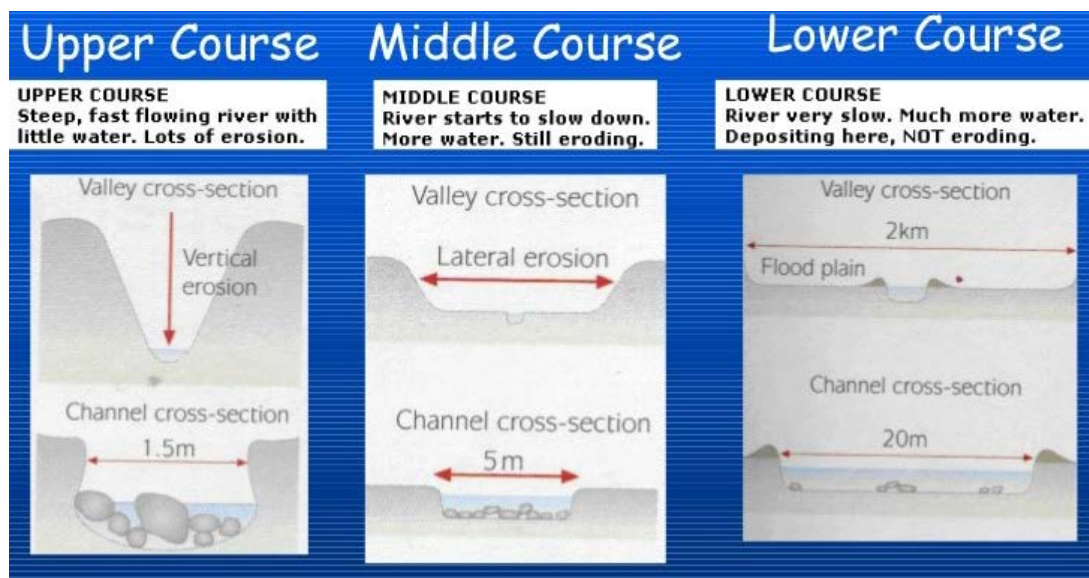
- drainage divide, divide, interfluvium or watershed.
(note: Watershed is used as catchment in North America.)

2 m (c) In the space below, draw (sketch) 2 labelled diagrams to show the **shape of the creek channel** at Point X and Point Y, respectively.

Answer (point marking – 0.5 marks for each correct aspect):

The channel cross sections (not the valley cross sections) shown for the Upper Course and Middle Course below are expected as an appropriate answer. The main features to be labelled/shown would include:

- Point X – narrower and shallower (0.5 marks) with larger boulders/rocks on the bed (0.5 marks)
- Point Y – wider and deeper (0.5 marks) with a smaller sized bed load (0.5 marks).



2 m (d) Give 2 reasons why the mean stream velocity is likely to be greater at point Y than point X as shown on the Figure: Farmhouse Creek (River).

Answer (point marking – any two factors (0.5 marks each) with a correct description of how that factor affects velocity):

Stream velocity is influenced by a number of factors including:

- The **shape of the channel** – the speed of flow is faster in channels that are as deep as they are wide compared with channels that are wide but very shallow or very deep and narrow
- The **roughness of the channel's bed and banks** – water flowing through a channel full of large rocks is more turbulent but slower than water flowing through a channel lined with fine silt
- **Discharge** – the greater the volume of water flowing the greater the velocity. (discharge at point Y has increased volume due to the contributions of tributaries)
- **The gradient, or slope, of the stream** – although the gradient decreases downstream, the volume (or discharge) is greater

3. Examine the data in the Table below.

Table: Water velocity in metres per second

Depth (m)	Distance from Left Bank (A) in metres				
	0.2	0.4	0.6	0.8	1.0
0.1	0.53	0.41	0.38	0.21	0.10
0.2	0.58	0.33	0.26	0.11	
0.3	0.46	0.22	0.18		
0.4	0.32	0.10	0.04		
0.5	0.15	0.05			

2 m

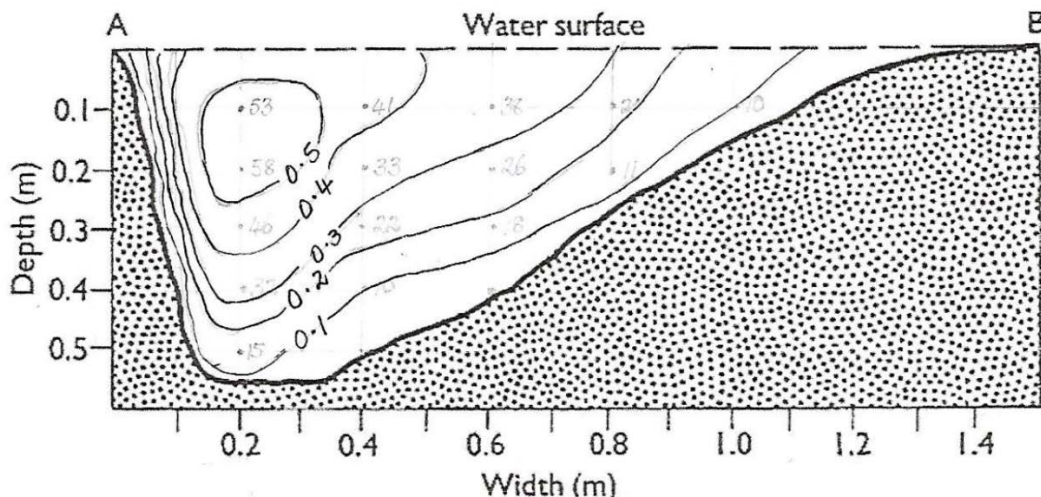
(a) On the Figure below:

- i) Plot the water velocities given in the table, and
- ii) Draw in isovels (lines of equal velocity) at intervals of 0.1 metres per second.

Answer (point marking – 0.5 marks for each correct point):

- the 0.5 m/s isovel is roughly a circle
- the isovels are closer together on the side of the channel closet to A (but not crossing)
- the isovels are more spread out on opposite channel
- The isovels are labelled correctly
- All (both sides) isovels should make contact with water surface, apart from fastest flow, in their correct position (allow minor error).

(Note – the isovels should not extend past the water surface)



2 m

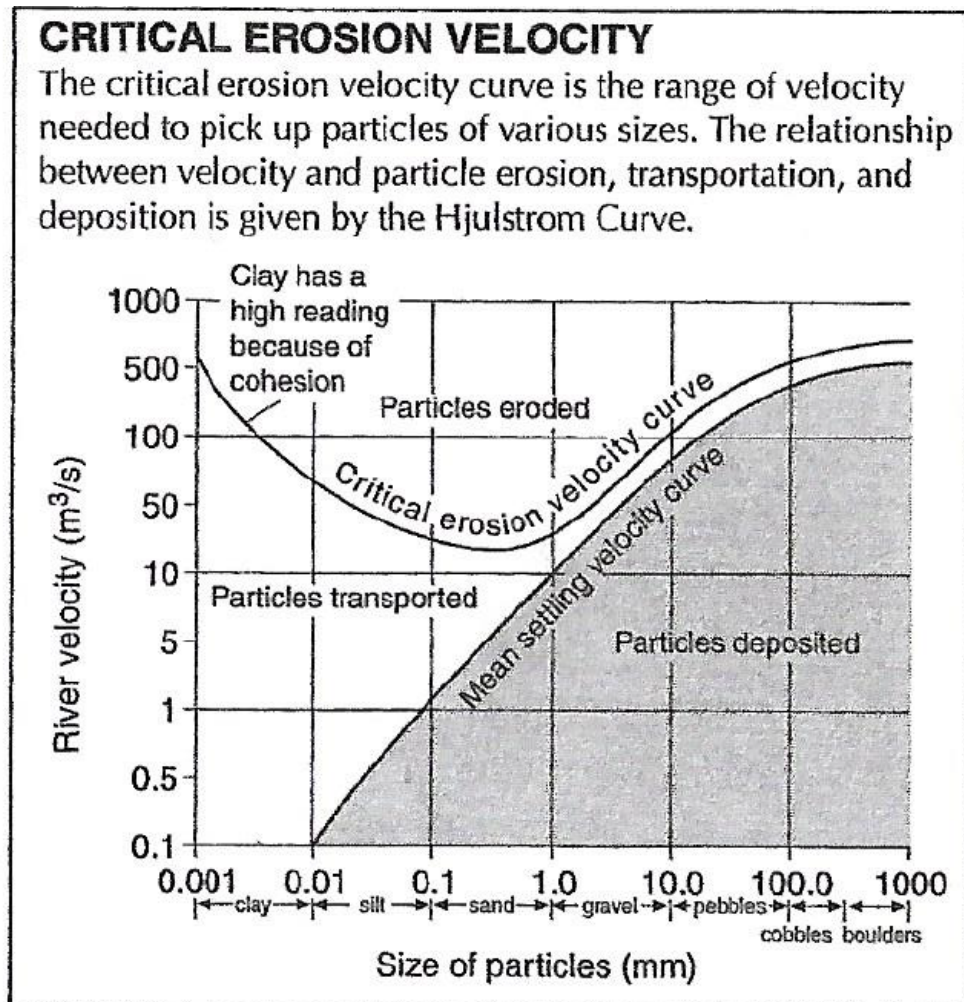
(b) Describe and explain variations across the channel.

Answer (point marking – 1 mark for a correct description and 1 mark for a correct explanation):

- Description - Water in the **middle** flows faster than water at the top (surface), sides and bottom
- Explanation - This is because there is **friction** where the water comes up against the air at the surface and the bed and banks of a stream channel.

4. Study the Figure below.

Figure: Hjulström Curve



1 m (a) Describe the relationship between the **settling velocity** and the **particle size**.

Answer (point marking – 0.5 marks for each correct point):

- The settling velocity declines/decreases more or less evenly with particle size.
- When the velocity declines to below the settling velocity, deposition occurs.

1 m (b) Explain why the **settling velocity** curve is below that for the **erosion velocity**.

Answer (point marking – 0.5 marks for each correct point):

- A lower velocity is required to **maintain** a grain in motion than to **start** a grain moving

2 m

5. Discuss why the statement “Everyone lives in a catchment” is important in catchment management.

Answer (level marking – 2 marks for each well elaborated change and 1 mark for poorly elaborated change):

- Catchments are dynamic, living things with features of natural and human environments. Catchment management means coordinating the use and management of all the resources and activities within each catchment: land, water, vegetation, land use
- Activities in one part of the catchment (e.g. forest clearing; uncontrolled discharge of industrial and domestic wastes) can have detrimental effects (e.g. silting of streams; eutrophication) in other parts of the Catchment.

Section E: Ebola Disease Outbreaks

The Ebola Virus Disease (EVD) epidemic in West Africa from 2014-2016 was a very serious health emergency.

2 m

1. Study Resource Booklet Figure E1: Key facts on Ebola **and** Figure E2: Distribution, frequency and magnitude of Ebola outbreaks to 30th November 2014.

Describe the pattern of Ebola outbreaks in Africa over time. In your answer, refer to both frequency and magnitude.

Answer (point marking – 1 marks for frequency and 1 marks for magnitude):

- Frequency - occasional outbreaks separated by periods with no outbreak. There were no outbreaks from 1976 until the 1994 -96 outbreak. The next outbreak 2000-03 outbreak followed by an outbreak in 2007. The only other outbreak before the 2014 outbreak was in 2012.
- Magnitude refers to the size or significance of the outbreak. In the past the outbreaks have been low level (with less than 1000 people being infected in any one year) until the most recent outbreak which is significantly higher than ever before with more than 17,000 people infected in 2014.

4 m

2. Study Figure E2: Distribution, frequency and magnitude of Ebola outbreaks to 30th November 2014 and Figure E3: Cases and deaths, Ebola outbreak to 27 March 2016.

Compare and contrast how the outbreak of the Ebola disease affected the **3** main countries between November 2014 and 27 March 2016.

Answer (point marking – 1 mark for each of 4 reasonable points of comparison and contrast.)

- Although the number of people infected in Liberia and Sierra Leone up to 30th November 2014 was very similar, Liberia had the greatest number people infected per 100,000 of the population with almost twice as many deaths as in Sierra Leone.
- By 27th March, 2016, the number of cases of infection in Sierra Leone had almost doubled to 14,124, with the number of deaths increasing from approximately 20% to one-third of all infections.
- Although the number of infected people in Liberia only increased by almost 30%, the number of deaths still remained approximately half of all cases.
- Guinea had the lowest rate of people infected per 100,000 of the population, but in both 2014 and 2016, it had the highest percentage increase in deaths – from 61% of infected cases to 67%.

3. Study Figure E4: Time series of cumulative Ebola deaths in the districts of Guinea, Liberia, and Sierra Leone, 2014-2015.

0.5 m (a) In what order should the maps be arranged to show the geographic spread of the Ebola disease in the three most affected countries?

Answer (point marking – 0.5 marks for correct order):

- 2, 3, 1, 4

1.5 m (b) Describe the origin and the spread of the Ebola disease.

Answer (point marking – 0.5 marks for each correct point):

- The Source of the Ebola outbreak was in a southern region of Guinea that borders both Sierra Leone and Liberia.
- The disease then spread into Liberia before moving into Sierra Leone.
- By 2015, only some districts in northern Guinea were Ebola free.

3 m 4. Identify and explain 2 factors that contributed to the failure to control this Ebola outbreak.

Answer (point marking –0.5 marks for correct identification and 1 mark for explanation):

- Identification of cases was difficult because of weak surveillance and a fragile public health infrastructure.
- Poor infection control measures and strained health care systems also contributed to the devastation of this outbreak.
- Failure to implement control measures -designed and implemented in prior outbreaks- in a timely manner.
- Population structure/geography:
 - Mobile populations; rural to urban migration affecting densely populated areas
 - Porous national borders
 - Multicountry spread
- Economic factors/lack of infrastructure:
 - Fragile states following recent civil wars
 - Lack of trust in government following historic corruption
 - Weak health systems
 - Poor transportation and telecommunication networks
 - Road networks along which infections spread
 - International air links
 - Lack of vehicles to access remote sites
- Cultural and behavioural factors:
 - Traditional burial rituals
 - Dependence on traditional healers
 - Secret societies
 - Community resistance, fuelled by lack of trust and disregard to cultural sensitivities at times
 - Conspiracy theories (e. g. hiding cases)
 - Civil disobedience

- Interventions/failure in response:
 - Delayed identification
 - Delayed and poorly coordinated international response
 - Weak governance and lack of local accountability within national/local response
 - Lack of evidence on effectiveness of interventions
 - Lack of experience in managing an outbreak on this scale
 - Lack of communication
 - Shortage of HCWs
 - Healthcare associated spread augmenting outbreak
 - Initial lack of community engagement and public information

2 m 5. Ebola outbreaks may cause various impacts for different groups in society such as **women** and **children**.

Select **one** of these two groups and explain why the impacts of the Ebola outbreak would be more serious for this group within society.

Answer (point marking –1 mark each for a comment about women or children, an extended explanation would gain an extra mark):

- **Women** are more likely to be the ones who are caring for the sick (1 mark) which means they are more likely to catch the disease (1 mark) and spread it as they complete their day to day tasks.
Or
- Schools have been closed which means that **children** are missing out on their education (1 mark) in the long term this could limit their abilities to get better paying employment (or similar for 1 mark)..

2 m 6. Study the Table below.

Identify the country which is likely to have had the best systems in place to respond to the Ebola outbreak. Give reasons for your answer.

Table: Statistical data on selected countries affected by the 2014-15 Ebola outbreak
(Source: WHO)

Country	Guinea	Liberia	Mali	Nigeria	Sierra Leone
Population (in millions)	12.61	4.50	17.60	182.20	6.45
Gross National Income per capita (PPP ¹ \$)	1,160	790	1,540	5,360	1,750
Government health expenditure per capita (PPP ¹ \$)	33	31	25	118	38
Medical doctors per 100,000	10.0	1.4	8.3	40.8	2.2
Population using improved sanitation %	20	17	25	29	13

¹Purchasing Power Parity (PPP) is used to make comparisons across different currencies

Answer (point marking –0.5 marks for identifying Nigeria and then 0.5 each for three valid points):

- Nigeria.
- Despite Nigeria's larger population, the country 's Gross National Income per capita (based on Purchasing Power Parity) of \$5360 is more than three times higher than Sierra Leone, Mali or Guinea and is nearly seven times greater than that of Liberia.
- The Nigerian Government's expenditure on health per capita is the highest of the countries listed, as is the number of 40.8 Medical Doctors per 100,000.
- 29 % of the population are using improved sanitation - although this is only marginally higher than the 25% in Mali.

Section F: Glaciers

1. Study Resource Booklet Figure F1: Photographs of main types of glaciers.

2 m (a) Name two differences between continental and valley glaciers.

Answer (point marking –1 mark for each significant difference):

- **Site/location:** Valley glaciers are glaciers that form in valleys in high, mountainous areas and are confined within steep walled valleys.
- **Size:** Continental glaciers are continuous masses of ice that are much larger than valley glaciers. Small continental glaciers are called ice fields. Big continental glaciers are called ice sheets. (Glaciers that cover broad, continent-sized areas are called continental glaciers)
- **Direction of flow:**
 - Valley glaciers, flow from high to low elevations. The downward erosive action of the ice carves the valley into a broad U shape (a mountain glacier whose flow is confined by valley walls.)
 - Continental glaciers (or ice sheets) flow over vast unconfined land areas. A continental glacier is thickest at its centre. The weight of the centre forces the rest of the glacier to flatten in all directions.

1 m (b) Name one specific location where each type of glacier may be found.

Answer (point marking – 0.5 mark each):

- Valley glaciers: e.g. Alps, Himalaya, Alaska
- Continental glaciers: e.g. Greenland, Antarctica
- Other possibilities
 - Valley glaciers are present at high altitude in mountain valleys of Alaska, the Italian Alps and New Zealand
 - Present day continental glaciers called "ice sheets" are found on Antarctica & Greenland

2. Study Resource Booklet Figure F2: Global glacier thickness change.

2 m (a) Describe the overall trend in cumulative global glacier thickness between 1961 and 2005.

Answer (point marking – 0.5 mark each for the 3 highlighted aspects and another 0.5 marks for some supporting evidence.)

- Overall, the cumulative global glacial thickness has **decreased** by approximately 12 metres. (Marks: 0.5 for decrease trend; another 0.5 for amount.)
- The trend has **accelerated** more recently – between 1970 and 1980, the cumulative global glacier thickness had decreased by 2 metres. Between 1990 and 2000, the decrease in thickness had almost doubled to 4 metres.
(Marks: 0.5 for accelerated decrease; another 0.5 for amount.)
- There was only year when the cumulative glacier thickness **increased slightly**- in 1992. (Marks: 0.5 for recognizing the increase; another 0.5 for the year)

(b) Explain why this trend in cumulative glacier thickness is occurring.

Answer (point marking – 0.5 mark only for **Global Warming** and 0.5 marks for each valid point):

- Today, glaciers are receding faster -almost everyone believes that the prime reason for this is sudden and rapid industrialization which in turn has caused global warming. Global warming is the rise in average global temperature that has happened over the past century
OR
- The likely cause of shrinking of glacier thickness is due to increasing temperatures, especially during late spring and summer, and substantially unchanged total precipitation, with marked reduction of snowfall, snow cover, number of snowfall events and duration of continuous snow cover, especially during spring and summer. The glacier thickness is reducing in size year after year because the falling snow is not able to replace the amount of melting ice.
OR
- Anthropogenic influences on the atmosphere could now represent a major contributing factor to the observed glacial shrinking on a global scale - the natural climate system has changed since the onset of the anthropogenic era. In the North Pacific, this means temperature and precipitation patterns are different today than they were during the preindustrial period."
OR
- Warmer temperatures in the tropical Pacific Ocean probably amplify warming at high elevations in the Arctic by changing air circulation patterns. Warmer tropics lead to higher atmospheric pressures and sunnier days over the mountains, which contribute to more glacial melting in the summer.
OR
- All currently available climate models predict a near-surface warming trend under the influence of rising levels of greenhouse gases in the atmosphere. In addition to the direct effects on climate—for example, on the frequency of heatwaves—this increase in surface temperatures has important consequences for glacier thickness.

3 m

3. Study Resource Booklet Figure F2: Global glacier thickness change.

Outline the extent to which volcanic eruptions such as El Chichón in March 1982, appear to have had an impact on the **overall trend** in global glacial thickness.

Answer (point marking –0.5 mark each for recognizing the increase and then decrease in thickness and 1 mark for explaining why in each case):

- The annual thickness of the glaciers tended to increase for a one or two years after the eruption. (0.5 marks)
(Note - Without the exception of Mt St Helens which resulted in a decrease in glacier thickness.)

Explanation:

- Volcanic eruptions have been known to cool the global climate. The ash plumes from El Chichón added a large load of sulphur dioxide and particulates to the atmosphere that circled the globe in a few weeks. This material helped warm the stratosphere (by 4°C) and cool the north hemisphere (by 0.4-0.6°C) – one of the most significant cases of cooling in the past few centuries. It also lowered atmospheric transmission of sunlight to the surface significantly. The haze from the eruption reduced visibility to a few kilometres as far as 700 km from the volcano and produced vibrant sunsets around the world. Then, the annual thickness of the glaciers tends to decrease at least for a year.
- Eruptions can be a major agent of glacier melting because the eruptions heave huge clouds of ash into the sky. When the ash falls on glacier, its darker colour allows the ice absorb more solar heat than usual.
Darker ice decreases the reflectance and it melts more quickly.

2 m

4. Taking into consideration the link between ice melting and changes of albedo, explain what the phrase “positive feedback” means?

Answer (point marking – 0.5 mark each for valid point):

- When ice melts the albedo decreases (the surface colour changes from bright to dark colour), which causes more sun energy to be absorbed and hence higher temperature, causing faster ice melting. Positive feedback is a change that causes reinforcement of its cause, which leads to speeding up the change.

OR

- Ice–albedo feedback is a positive feedback climate process where a change in the surface of glaciers alters the albedo.

It is due to this increase in temperature that glaciers are melting more than they actually should. When a glacier melts fully, it exposes the earth below. Glaciers absorb approximately 20% heat from the sun, reflecting back 80%. When the earth gets exposed, this percentage gets reversed, increasing the amount of solar energy absorbed. This in turn causes a further increase in temperature and more melting. This is a vicious trap which has already begun and it will be almost impossible for us to stop it totally

5. Study Resource Booklet Figure F3: Climatic snow line.

Although glaciers are most commonly found above the snowline, the snow line varies around the globe. Thus, location at a certain latitude and altitude does not automatically mean that a glacier will develop.

Explain 4 factors that will determine if a glacier forms at a particular latitude and altitude.

Answer (point marking – 0.5 mark for each correct factor):

- **Altitude:** influences local temperature (Lapse rate = $\pm 9.8-4^{\circ}\text{C}/\text{km}$ --air cooling with decreasing pressure) and precipitation patterns
- **Latitude:** Controls total annual solar radiation. The higher the latitude the lower the regional snowline (The snow line is much higher near the equator (about 15,000 feet), for example, than it is near the poles (sea level or 0 feet in altitude))
- **Relief:** Glaciers need a relatively flat surface on which to develop. Regions of steep variable relief generally have variable snowlines owing to steep slopes that inhibit ice formation, and snow avalanching that nourishes adjacent valley floors
- **Orientation (Aspect):** Influences the amount of solar radiation and wind-blown snow received (On windward slopes and those facing the afternoon sun, the snow line may be as much as a kilometre (more than half a mile) higher than on opposite slopes)
- **Distance from the ocean and dominant wind pattern:** Affects amount and distribution of precipitation. Coastal mountains typically have healthier glaciers. (Mountains that are near coastlines may have a lower snow line than other areas with the same altitude and latitude. As you get closer to a coastline, the amount of moisture in the air tends to produce more snowfall at higher altitudes)
- **Temperature:** The snowline lies around the 0° isotherm for most glaciers,
- **Precipitation:** Glaciers cannot exist without precipitation. (In the Andes Mountains of South America, it is so dry that the mountains rarely see snow, despite their height and distance from the equator.)

end ■