ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Geography 5036
Specification B

GGB2 The Physical Options

Mark Scheme

2006 examination – June series

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

GGB2

General Instructions to Examiners on marking.

It is important that every Examiner marks the scripts to the same standard as the rest of the panel. All Examiners must operate the Marking Scheme in a similar and consistent manner, and hence they must all participate in the application of that scheme at the Standardisation Meeting. In particular they should take careful note of all decisions taken or changes made at that meeting. Examiners are allocated to a Team Leader for the period of examining, and any difficulties that arise should be discussed with that person.

The Marking Scheme

The Marking Scheme consists of two sections for each question or sub-question – the Notes for Answers and the Mark Scheme itself.

Notes for Answers (NFA):

These indicate the possible content for the various sections of the question paper. In some cases (for example short answer questions) the NFA might indicate the only response that is acceptable, but in many cases they indicate either a range of suitable responses, or an exemplar of the type of response required. Therefore in most cases, the NFA do **not** provide model answers, and should be regarded as such. More NFA may be added at the standardisation meeting if it is felt by the Principal Examiner that details of appropriate ways of answering the question have been omitted.

The Mark Scheme

This is provided in italics and provides the instructions to Examiners as to how they are to assess the work of candidates. The number of marks allocated within the mark scheme to a question should correspond to the number of marks for that question on the question paper.

There are two ways in which the Mark Scheme operates:

(a) It indicates how the marks to short answer questions are to be allocated – usually to a maximum of 4 marks.

(b) It indicates how Examiners should move through the levels in a level response mark scheme -– usually to all questions of 5 marks or more. Each level has a levels descriptor, with clear statements of the "triggers" to move candidates from one level to another. Each Level contains a range of marks as shown on the Mark Scheme.

A number of features have been used to distinguish between levels, for example:

- a number of characteristics, reasons, attitudes etc.
- the degree of specification, for example the use of specification case studies, or accurate detail
- responses to more than one command word, for example, describe and suggest reasons
- the degree of linkage between two aspects of the question
- the depth of understanding of a concept.

The Marking process.

A sample of the Examiner's marked scripts will be marked again by a Senior Examiner according to the procedures set out by the Board. Also the scripts may be re-examined at the Awards Meetings and the subsequent Grade Review. Therefore, it is most important that Examiners mark clearly according to the procedures set out below.

- All marking should be done in red.
- The right-hand margin should be used for marks only.
- The overall mark for a question must be ringed at the end of the answer.
- The total mark for the question must be transferred to the front of the script.
- The left hand margin is where an indication of the level achieved is written. Comments and codes (see below) may also be written on the left.
- Indications of the level achieved may also occur in the body of the answer if this is easier for the Examiner to apply (e.g. in the marking of diagrams).
- Ticks should be used for short answer responses and Level I responses only, with one tick representing one mark (to the maximum allowed in a Levels scheme).
- Levels II, III, and IV should be indicated with a Roman II, III or IV on the script, and this symbol should be used each time this Level is achieved. Examiners may wish to bracket an area of text where this level of response has been achieved.
- Once a candidate has reached Level II, additional Level I credit should be indicated using a + symbol. If these points are of sufficient quality **one additional mark** can be awarded (assuming no further Level II points are made).
- Examiners may indicate strong Level II or III material by writing "Level II (or III) – good" in the left hand margin of the script. The Examiner should ensure that this is reflected in the **awarding of an appropriate number of marks** at the end of the answer.
- Level III is to be used only for questions of 9 marks or more, and Level IV is to be used only for questions of 25 marks in total.

Other Mechanics of Marking

- Underline all errors and contradictions.
- Cross out irrelevant sections using a line from top-left to bottom right. (However be careful to check that there is no valid material, however brief, in the mass of irrelevance.)
- Indicate repeated material with "rep".
- Other useful marking codes can be used, for example, "va" for vague, "NQ" or "Not Qu." For failure to answer the question, "Irrel" for irrelevant material, and SIF" for self-penalising material.
- Put a wavy line in the left-hand margin to indicate weak dubious material.
- If the rubric is contravened, mark all answers but count only the best mark towards the candidate's total mark for the script. Put the mark for the question on the front of the script in the usual way, but also write "RAM Rubric" on the front of the script.
- Large areas of text must not be left blank – use the wavy line or write "seen" alongside the text. All pages must have indication that they have been read, especially supplementary sheets.
- Unless indicated otherwise always mark text before marking maps and diagrams – do not give double credit for the same point made in the text and a diagram.

Triggers and some level descriptors

- Named feature, named example, named location = level 1

- Described feature = level 2
- Accurate quantitative description, correct location of plant species = 2 times level 2 max
- Named process = level 1
- Process + effect = level 2
- Process explained = level 2
- Explained process + effect = good level 2
- Explained process + effect described = very good level 2

Question 1

(a) (i) 1. Accumulation is the net gain in an ice mass. Inputs to the ice can include:
Snow, re-freezing of meltwater, avalanche, drifting, rockfall. It is dominant in upper parts of a glacier.

2. Ablation is the collective loss of water from a glacier or ice sheet. It could be from: Melting (meltwater streams), calving, evaporation/sublimation.

1 mark for each valid point made. There must be at least one mention of net change to gain maximum. 1 mark max for location and 1 max for seasonality. **(0-4 marks)** **(0-4 marks)**

(ii) There has been almost continuous and uniform retreat. Short advances 70 – 73 and 80 – 82. Standstill 88 – 90. Total retreat 2950m in 65 years (45m per year).

Level 1 **(0-2 marks)**
Simple description of trends or anomalies.

Level 2 **(3-5 marks)**
Detailed use of the graph using both axes etc.

(iii) **Internal Deformation** (Inter-granular flow; intra-granular flow; regelation).
Ice deforms under its own weight because of gravity. The deformation actually is because of the sum of tiny movements on the faces of the ice crystals making up the glacier. The thicker the ice, the faster the flow because of internal deformation. The warmer the ice, the faster the movement.
Movement of a glacier by internal deformation is very slow, and is on the order of tens of metres per year. Much of the movement of the interior of the Antarctic ice sheet is by internal deformation.

Basal Sliding:
True basal sliding means that the base of the ice sheet is near the pressure melting point and that some water is present. The pressure melting point is reached because high pressure actually reduces the temperature at which ice will melt. Ice at base of a 2200m thick ice sheet will melt at – 1.6°C rather than at 0°C. The thicker the ice, the lower the temperature at which it will melt, and the higher the chance that some water will be available at the glacier base to enhance movement. Large parts of the West Antarctic glaciers are at the basal melting point, so there may be large areas under the glaciers sheet where a thin water layer exists. Water reduces friction and allows the ice to move faster. A thin layer of water may be present at the glacier base because the ice is at the pressure melting point. Or, the water may come from rain water or surface meltwater that has worked through the cracks in the ice. Or, it may originate from melting upstream in the glacier. This water then flows toward the terminus (nose) of the glacier.

Movement by basal sliding is ten times faster than movement by **internal deformation**. Basal sliding is extremely important in how much a glacier erodes the landscape, and the features that are created by the ice.
Deforming Substrate Water is not the only material that can cause sliding; sediment, or the rock debris under the ice, also can increase movement at the base of a glacier. If the glacier is sitting on a soft sediment bed that has some water in it, the sediment can move and carry the ice sheet with it just as if it were riding on a water layer.
Other relevant processes include: extending/compressing flow; simple effect of gravity; faulting; surging, rotational flow etc.

Level 1 **(0-3 marks)**
Simple description of glacial movement and/or basic definitions of types of glacial movement.

Level 2 **(4-8 marks)**
Detailed description of glacial movement (2xL2Q maximum) and detail of types of glacial movement. There must be at least one explanation (annotated E) at L2 to gain full marks. No limit on explanation.

(b) Glacial troughs: minimum length 1km, maximum 50km?? Width 0.5km to 3km. Length much greater than width. Steep sides, only vertical in a few places. Floor is flat, post-glacial alluvium occupied by misfit river and possible roches moutonnees. Waterfalls from hanging valleys on the side which often leave an alluvial fan. Can be occupied also by glacial (pater noster) lakes. Sides have truncated spurs. Formation by processes of glacial erosion (plucking and mainly abrasion. Straightened by the lack of flexibility of the ice, etc. etc. Post glacial effects are relevant when they shape the landforms.

Level 1 **(0-3 marks)**
Simple description of the trough and associated features (e.g. U-shaped valley). Named relevant process. Named example.

Level 2 **(4-8 marks)**
Detailed description of the trough (2xL2Q maximum). Detailed explanation of formation. Links between processes and shape of landform. At least one explanation for maximum (annotated E) of any associated feature. Processes not linked to characteristics, 1XL2max.

(c) Depends on the example chosen. Simple ideas of the ice acting as a dam, causing there to be a proglacial lake, are the most likely. This overflows through a col, which remains as the river route in post-glacial times. The role of glacial deposition acting as a dam is relevant. A diagram is not necessary.

Level 1 **(0-3 marks)**
Simple ideas relating to the role of ice to the change in a river's direction. Name of an example.

Level 2 **(4-6 marks)**
*Detailed description of an example of glacial diversion **or** a detailed generic account of drainage diversion. Do not differentiate between direct and indirect effects. Diagram is not necessary for full marks.*

(d) (i) Continuous PF occupies all the land closest to the North Pole except N Scandinavia and NW Russia. It extends as far south as 53/2°N in central Asia, while it only reaches 55°N in N America. Occupies all but the south tip of Greenland. The Discontinuous PF is found south of the continuous, though it reaches the Arctic Ocean in N Scandinavia and NW Russia. Extends to 47° N in central Asia, and 52°N in Canada. Least southward extent is 67°N in Scandinavia. Descriptions related to things not on the map are relevant e.g. N Atlantic Drift.

Level 1 **(0-3 marks)**
Simple description with little use of latitude or directions.

Level 2 **(4-7 marks)**
Detailed description of distribution using the latitude lines and naming areas.

(ii) Treat all of the following as variations of one landform.
Stone polygon: 1 – 5m diameter; dome height 0.1 – 1m. Fine clay in the middle. Angular stones around.
Elongated polygons: 2-6, stripes 6° – 35° etc. If candidate gives 'patterned ground' then allow all of above.
Solifluction lobe.
Pipkrakes: (15cm high 4cm wide) grow vertically, stone/soil on top. Banded showing individual freezing cycle. These are formed by Frost Heave: occurs in the active layer above permafrost. Stones in the ground have a higher thermal conductivity/lower specific heat capacity than soil around. This means that ground under stones is colder than the surrounding sediments and ice lenses develop. They increase in size by migration of water to the lens. As the lens grows, it forces the stone above to move upwards. When the lens melts, the void is filled with sediment and stops the stone from falling back.
Ice wedge polygon and wedges: diameter 5 – 50m; depth 10m; thickness 0.5 – 20m. Created by the contraction of ground upon severe freezing, allowing meltwater and silt to occupy and expand the crack.
Scree: slope 30 – 35 degrees. Created by freeze/thaw.
Nivation: the migration of water in the permafrost on hollow: 5m to 1km diameter, 2 – 20m depth. Created by nivation processes of snow accumulation, freeze/thaw and seasonal washing out of debris.
Pingo: 50 – 500m diameter, height 10 – 60m. Formed by the migration of water in the permafrost, the subsequent freezing and expansion of that water etc.

Level 1 **(0-3 marks)**

Simple description of chosen landform. Named relevant process. Named example.

Level 2 **(4-8 marks)**

Detailed description of landform (2xL2Q maximum). Detailed explanation of formation. Links between processes and shape of landform. At least one explanation for maximum (annotated E).

OPTION Q: COASTAL ENVIRONMENTS

Question 2

(a) (i) Constructive wave: main features include; long wavelength (10 – 100m) with a low frequency (6 – 10 per minute). They have a low height (less than 1m) and low steepness. They are spilling waves with a swash greater than backwash. Elliptical orbit.
Destructive wave: short wavelength (maximum 50m) high (1m+), steep with a frequency of 10+ per minute. They are plunging waves with a swash weaker than backwash. Circular orbit.

1 mark for each valid point made. There must be one correct swash/backwash relationship to gain max for each. No credits for effects of waves. **(0-4 marks) (0-4 marks)**

(ii) Wave refraction is the process that occurs to waves as they approach an irregularly shaped coastline. As soon as the depth becomes less than 2 wavelengths the sea bed begins to slow down the wave. This happens first off headlands while waves going into a bay continue at the original rate. This causes the waves to bend and adopt the shape of the coastline. This means that wave energy is concentrated on headlands and dissipated in the bays.

Level 1 **(0-3 marks)**
Simple definition of the term with no detail linking the nature of the coast to the wave.

Level 2 **(4-6 marks)**
Detail of refraction either by explaining how the process occurs. At least 1 L2 for diagram to gain max.

(b) (i) Sand dunes: There are 5 areas of sand dunes that form narrow strips of deposits parallel to the coast. The widest is just over 1km north of Barmouth, the narrowest is 200m (approximately) near Tywyn. The longest continuous stretch is near Harlech (7km) and the shortest is 2km just south of there. They are all south of an estuary on spits.
The salt marshes are found parallel to the rivers. The largest appears to be along the Mawddach extending 18km inland and nearly 3km wide.

Level 1 **(0-3 marks)**
Simple description with little use of scale, field relationships or direction.

Level 2 **(4-7 marks)**
Detailed description of distribution using the scale accurately and/or relating one aspect of the coast to another.

(ii) Depends on the feature chosen.
Likely to be a spit. Relevant description can be either of a named example or a generic feature. Descriptions of scale, field relationships, deposits and appearance are all relevant.
Spits occur at river mouths and where the coastline changes direction. If the LSD brings material along the coast, as soon as the water deepens and the waves no longer break (resulting in inability to move material), then deposition occurs. There is a shallowing of the water and so waves can break and so LSD can occur. Eventually this is colonised by vegetation whose roots hold together the sediment, and allow it to become stabilised.

LSD is the movement of sediment along a coast by wave action. Waves approaching the beach at an angle (under the influence of the wind), the swash pushes the beach material up the beach at the same angle. When the wave recedes, it does so at right angles to the beach and the backwash removes beach material seawards. Thus the sediment moves in a zig-zag fashion.

Level 1 **(0-3 marks)**
Simple description of chosen landform. Named relevant process. Named example.

Level 2 **(4-8 marks)**
Detailed description of landform (2xL2Q maximum). Detailed explanation of formation. Links between processes and shape of landform. At least one explanation for maximum (annotated E). LSD on its own only gets 1XL2.

(c) (i) Eustatic: Global SL change. Caused by the increase/decrease of the mass/volume of water in the oceans. Decrease caused by glaciation on land interrupting the hydro cycle or cooling; increase caused by glacial melting or warming. Also caused by the thermal expansion/contraction of sea water. Same rate of change worldwide.

Level 1 **(0-2 marks)**
Simple definition of the term (e.g. worldwide) or simple reasons for change.

Level 2 **(3-5 marks)**
Detailed reasons for the change.

(ii) The height of the ice advance, weight of ice has depressed the lithosere well below the former level. This depression extends out beyond the ice for 150 – 180km and creates a bulge (SE England) that rises above the former level. Isostatic rebound is relatively slow, and so when the ice is removed, the N will rebound back to its former level (i.e. Scotland rising) and the forebulge will sink.
Result for sea levels is that:
Sea levels rose in NW Britain and fell in the SE during the ice advance.
Sea levels are falling in NW Scotland and rising in SE England.

Level 1 **(0-3 marks)**

Simple statements regarding the sinking/rising of the lithosphere as a result of ice advance. No link to sea level change.

Level 2 **(4-8 marks)**

Detailed links made between the ice advance, lithospheric depression/bulge and sea level change.

(iii) Local sea level changes:
A barrier reef is separated from land. In the case of the Great Australian Barrier reef there is a fault line that lies parallel to the coast so that as the coral grows it sinks relative to the land. This gives the reef material great depth. In other cases the Darwinian theory states that the islands sink and the coral is able to grow at the same rate as the sinking. The atoll is the last stage in the Darwinian theory, where the island has sunk completely, but the coral has grown in the shallow water.
Global sea level changes:
Other more recent theories state that the growth of atoll are more to do with a global base level change. As sea levels fell during the last ice age, the islands were planed off by marine erosion. As global sea levels rose again, the coral grew with it. In very recent times, the rising sea levels threaten the existence of low lying coral islands and their economies, e.g. The Maldives.
One level 2 only for correct generic marine conditions. Descriptions of coral reefs are best left to named examples.

Level 1 **(0-3 marks)**

Simple description of reefs or simple link between the nature of reefs and changes in sea level.

Level 2 **(4-8 marks)**

Detailed description of reefs (2xL2Q maximum). Detailed link between a particular type of base level change and the effect on a reef. Must have both D and E at L2 to gain maximum mark.

OPTION R: URBAN PHYSICAL GEOGRAPHY

Question 3

(a) (i) The city that has grown the most is Los Angeles at 0.45°C per decade. It is followed by Tokyo at 0.33°C per decade. The 2 lowest growing cities are Fort Lauderdale and Shanghai at 0.11/2°C per decade, a quarter of the rate of LA. Big difference between LA and San Francisco, although they are quite close together geographically.

1 mark for each valid point made. **(0-4 marks)**

(ii) The question concentrates on the growing nature of the UHI rather than reasons for UHI in themselves. Any valid reason is to be accepted.
These reasons could include:
Growth of urban areas so that there are more of the factors that lead to the UHI.
Increase in traffic, especially in the USA and in Tokyo.
Industrialisation of China, with the recent economic boom etc. etc.

Level 1 **(0-3 marks)**
Simple reasons for the growth of the UHI or reasons for UHIs themselves.

Level 2 **(4-6 marks)**
Detailed reasons for the growth of UHI's..

(b) (i) Nearly all the high levels of thunderstorm rain (TR) appear to be around major urban centres with the exception of area NW of London. The largest area of 80+mm is in the Greater London area. Other major areas are to be found round Ashford, Guildford (?) and Portsmouth. There are areas of low frequency of TR in the Lower Thames, Sussex/Hampshire areas, etc. etc.

Level 1 **(0-3 marks)**
Simple description of the TR distribution with little or no reference to the scale or detail of location.

Level 2 **(4-6 marks)**
Detailed description of the distribution using the scale, direction, accurately.

(ii) Thunderstorms are more common in urban areas for two main reasons. The main one is that the UHI creates a localised area of low pressure which draws in air from the surrounding area. As the air approaches the urban area it warms up. This warm air is then subject to convectional uplift. This uplift accelerates as the rate of cooling of the rising air is less than that of the surrounding air, making the temperature difference even greater. Large cumulonimbus clouds develop and storms occur. The whole thing is aided also by the presence of a greater number of hygroscopic nuclei in the form of particulate pollution.
NB. Reasons for the UHI are not credited.

Level 1 **(0-3 marks)**
Simple statement regarding the fact that urban areas are warmer than surrounding or the presence of particulates.

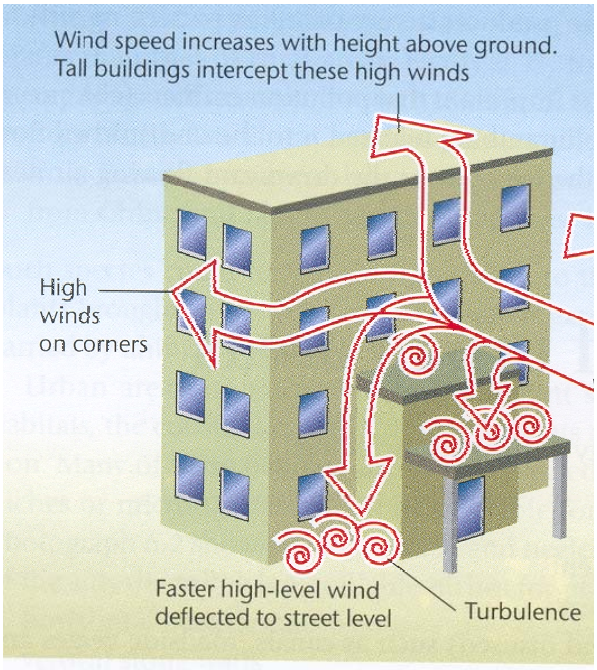
Level 2 **(4-7 marks)**
Links between the warmth of the urban area and the uplift of air resulting in convectional rain.

(c) (i) Urban areas reduce average wind speed by increasing the friction between the surface and the moving air. NB. There may be some confusion between speed and velocity. The velocity is reduced because winds are sent into all directions by reflection and deflection. This does not necessarily reduce their speed.
Not only is there increased friction but there are areas completely sheltered from the wind by deflection. This gives zero speed which can greatly reduce the average speed despite the high speed gusts.
The occurrence of gusts or heavy turbulence results from flows that are caused at the interface of air zones having different pressures. For instance, on the windward side of an obstacle, there is overpressure which increases with height, under the influence of the velocity gradient. This causes a descending flow along the front side, which forms a vortex when it reaches the ground and sweeps around the windward corners. It is considerably increased if there is a small building to the windward. In the lee of the buildings there is a zone of lower pressure causing vortices behind it.
Candidates may describe the Venturi effect, produced by two separate buildings whose axes make an acute or right angle. Thus the pressure of the airflow is concentrated on the gap between the buildings giving great velocities. Channelling is caused when there are urban 'canyons' which concentrate all airflow in one direction.
Calms are caused by the fact that there is greater friction in the urban area causing the wind to slow down, or in the 'wake' of buildings.

Level 1
Simple description of varying wind speed and/or frequency. Simple (one word) explanation. **(0-3 marks)**

Level 2
Detailed description of varying wind speed and/or frequency. Detailed explanation. Must have on L2 explanation (annotated E) to gain max. **(4-8 marks)**

(ii)



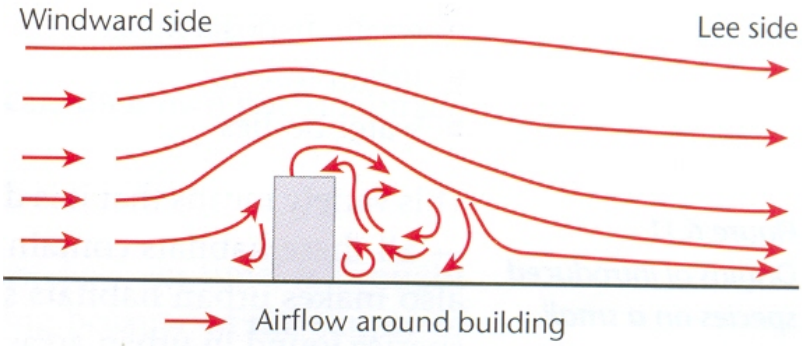


Figure 6.9 Airflow modified by a single building

Level 1 **(0-3 marks)**
*Simple labels **or** arrows showing the changing direction of air flow. Simple description of effects.*

Level 2 **(4-6 marks)**
Arrows showing the change in air flow correctly labelled or annotated. Detailed description of effects. At least one L2 in diagram to gain max.

(d) (i) Although candidates will use examples of areas that they have studied, most will probably follow along the lines of urban succession as outlined by Gilbert. Thus there are likely to be mosses and lichens followed by the pioneers of the Oxford Ragwort stage followed by the tall herb stage, the grassland stage, scrub woodland and the possibility of a full woodland stage.

There will be variations caused by the original nature of the site (the substratum), the role of chance, regional variations and human intervention. Substratum variations could include acid/alkali conditions, wetland, ponds etc. The sequence of changes from one vegetation sere to another is valid. NB. Any one factor causing seral change can be accepted only once unless further developed (e.g. particular types of competition such as access to moisture, light, nutrients etc.). e.g. an abandoned factory site, mosses and lichens can begin to develop on the bare concrete. They are able to exist in areas where there is little water. They extract nutrients from the sun and from the bare concrete below. When they die they provide a thin mat of organic matter and some weathered mineral material which mixes to provide a protosoil that other plant species can use to root into. Cracks in the surface provide a sheltered place for seeds to germinate. They also retain moisture and dust etc. which again help plants to root. The most common invaders are plants with windblown seeds, e.g. Oxford Ragwort. This has a long flowering season enabling it to produce millions of seeds. As these higher plants die off they produce thicket and more nutrient rich soil. Taller plants that are more nutrient demanding can then establish. These could be e.g. Rosebay Willowherb. These shade out the smaller plants stopping them photosynthesising so easily. In turn the taller herbaceous plants are replaced by shrubs and eventually trees, the most common being the sycamore. All the while the processes of soil enrichment and competition continue.

Level 1 **(0-3 marks)**

Simple description of the sequence of vegetation succession on a cleared surface.

Level 2 **(4-8 marks)**

Detailed description of the plant succession, including succession sequences. Reasons for the nature of the succession. There must be at least one L2 reason to gain maximum marks. 2XL2Sp max. 2XL2SeqMax

(ii) The difference between this and the question before is that this is succession that has been influenced deliberately by man. The nature of the development will depend on the example chosen. The answer should focus on the managed aspect of the area, thus one which is simply left alone to go through the succession is not relevant. Management techniques include the reduction in acidity of old industrial and coal spoil sites by addition of lime etc. The deliberate clearing of areas to create a variety of habitats for smaller light demanding species. Some areas have a system whereby mowing is only done once meadow wildflowers have flowered.

Level 1 **(0-2 marks)**

Description of the example that has been studied with one activity that has been carried out to show the effect of human interference.

Level 2 **(3-5 marks)**

Detailed description of the area of ecological conservation ***or*** *detailed description of the work done there* ***or*** *a generalised account of the work related to the examples.*