

**UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS**  
GCE Advanced Subsidiary Level and GCE Advanced Level

**MARK SCHEME for the May/June 2012 question paper**  
**for the guidance of teachers**

**9696 GEOGRAPHY**

**9696/11**

Paper 1 (Core Geography), maximum raw mark 100

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### Section A

#### Hydrology and fluvial geomorphology

**1 Fig.1 shows water flows into a river channel.**

**(a) Name the flows marked on Fig.1 as:**

- (i) A;** Overland flow (Hortonian), surface flow, runoff **[1]**
- (ii) B;** Saturated overland flow **[1]**
- (iii) C;** Throughflow **[1]**
- (iv) D.** Groundwater flow (baseflow) **[1]**

**(b) Briefly explain the ways in which precipitation reaches the river channel in Fig.1. [6]**

Precipitation falling on the slope flows as overland flow when rainfall intensity exceeds infiltration capacity. This is termed Hortonian overland flow. Water that is infiltrated into the soil flows under gravity downslope through percolines and pipes as throughflow. In circumstances whereby soils at the base of the slope become saturated from above, throughflow can be diverted to the surface and flow as saturated overland flow. Infiltrated water can be percolated through cracks and joints in rocks to reach the permanently saturated area of the water table. Here it will flow under gravity and hydrostatic pressure downslope to the river channel.

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## Atmosphere and weather

2 Fig.2 shows a diagram of unstable atmospheric conditions.

(a) On Fig. 2 label:

(i) dry adiabatic lapse rate (DALR); [1]

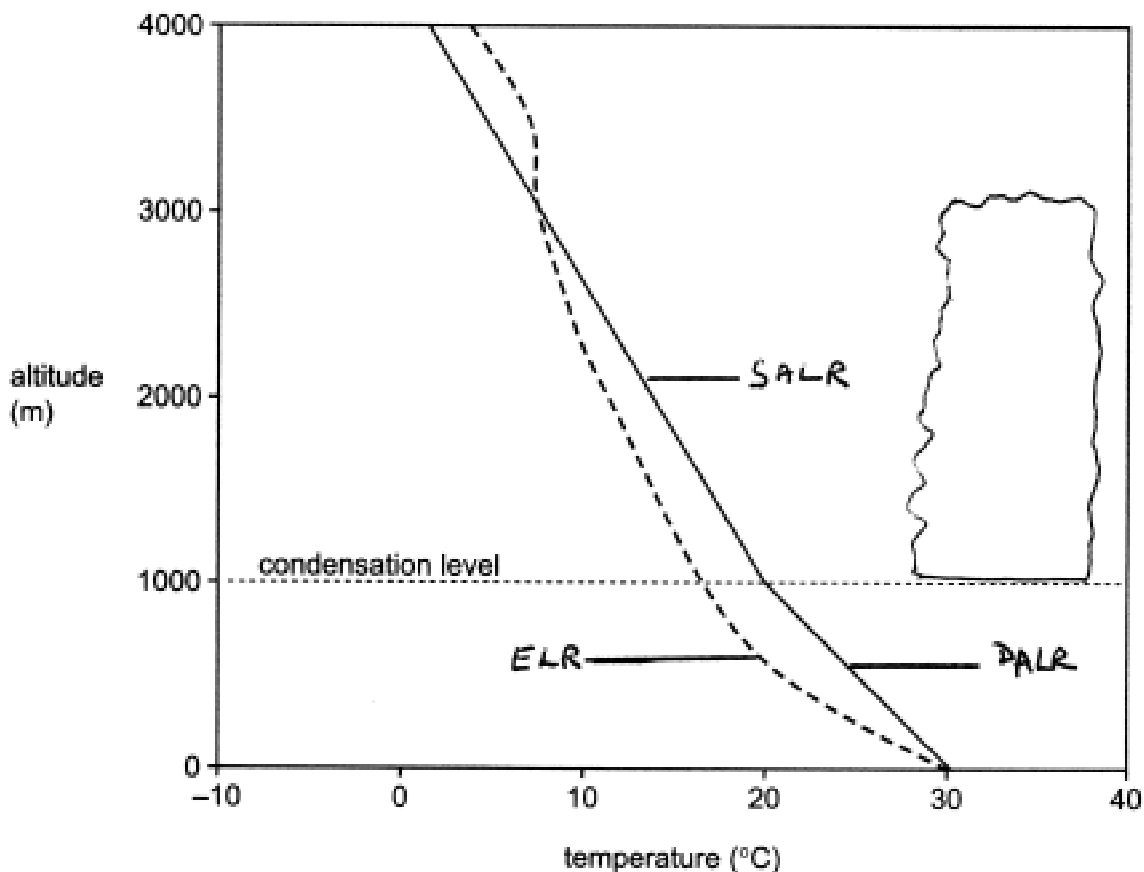
DALR – solid line below condensation level

(ii) saturated adiabatic lapse rate (SALR); [1]

SALR solid line above condensation level

(iii) environmental lapse rate (ELR). [1]

ELR –dotted line



(b) On Fig. 2, draw a towering cumulus cloud showing its location and vertical extent. [2]

The cloud should be flat based at condensation level and extend vertically to 3000 m

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**(c) Explain how instability occurs and describe the weather that may result. [5]**

Due to heating at the earth's surface (convection) a parcel of air will become less dense and hence rise. It will rise at the DALR which in this case is warmer than the ELR and hence will continue to rise as it is cooling at a slower rate than in the ELR. The air cools adiabatically (until its humidity is such that condensation occurs at condensation or dew point level). The air will continue to rise at a lower rate (SALR) due to the latent heat of condensation as the air parcel remains warmer than the ELR. At 3000 m the ELR and SALR are equal and uplift ceases. At condensation level, condensation occurs around hygroscopic nuclei to form clouds. With continued uplift this cloud can take the form of cumulo-nimbus cloud with great vertical extent which could bring about rainfall and even thunderstorms.

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## Rocks and weathering

### 3 Table 1 shows two processes of chemical weathering.

- (a) (i) Name the weathering process in A. [1]

Carbonation

- (ii) Name the weathering process in B. [1]

Oxidation

- (b) Briefly describe how climate can aid the operation of one of the processes shown in Table 1 [3]

These chemical processes require water (precipitation) to dissolve carbon dioxide and oxygen. Higher temperatures speed up the processes (Van t'Hoff's law)

- (c) Explain how the processes shown in Table 1 weather rock. [5]

Carbonation occurs when precipitation falling through the atmosphere absorbs carbon dioxide to form a weak carbonic acid (first equation). This acidulated rainwater will react with rock containing calcium carbonate (principally limestone). Limestone is not a soft rock but cracks, joints and bedding planes will allow ingress of the acidulated water that can thus impact upon a wider surface area. Reactions will be speeded up under higher temperatures such as those experienced in the tropics. The carbonic acid reacts with the calcium carbonate to produce a bicarbonate which is soluble. It is then washed away leading to a widening of joints, etc and the development of solution hollows, etc.

Oxidation relies on the oxygen within water to react with rock minerals, especially iron, to produce oxides and hydroxides. This manifests itself as a brownish/red staining that looks like rusting and will eventually lead to a crumbling of the rock or granular disintegration.

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## Population

4 Fig. 3 shows the main elements of population change.

(a) Using Fig. 3, name:

(i) A; Net migration/migration

(ii) B. Mortality Rate (death rate and infant mortality rate) or Death Rate [2]

(b) Explain how variations in the birth rate can affect population change. [3]

Need to show how increases and decreases in the birth rate would affect population growth. A higher birth rate should lead to an increase in population, provided the birth rate remained above death rate and vice versa. Candidates should have increase and decrease and ideally include a reference to death rates/mortality as an essential component of population change.

(c) Describe and explain the economic factors that can influence birth rates. [5]

Must refer to economic factors only. For example

Level of family income

Economic cost/benefit of having children

At a national level – access to family planning

Education level, esp. women

Access to medical care (influence IMR, therefore poss. FR)

Gov. population policy influenced by economic forecasts

Can be both increasing and decreasing birth rates.

Ideally candidates would describe at least two factors with a reasonable explanation of how they affect fertility. Reserve 1 for developed points that may suggest links between the factors, e.g. government policy and family planning, family income and cost/benefit of children. Max 3 for a simple list, with no explanation.

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## Migration

5 Fig. 4 shows the population structure for immigrants (foreign born) in the USA, an MEDC, in 2000.

(a) (i) Which age group has the greatest number of male immigrants? [1]

30–34 years

(ii) Using data from Fig. 4, describe the main characteristics of the immigrant population. [4]

Candidates should be able to pick up the 'diamond-shape', typical of an immigrant population. Answers could include reference to the narrow base, indicating few in the lower age ranges of 0–15 years, which tapers upward and outward from the base as the age ranges start to pick up the 'bulge' in the 20–39 ranges, representing the typical age of economic migrants. The structure then begins to narrow again after 39+ age range, as fewer people of this age group undertake migration.

(b) Outline the possible impacts of an immigrant population, like the one shown in Fig. 4, on a receiving country [5]

Answers could (and ideally should) include positive and negative aspects. Generally a population structure such as this represents a large workforce, often prepared to undertake less popular jobs. Consequently they are a beneficial input to the economy. Provided these are legal immigrants they will be paying tax and other state contributions. Equally, if the country has a declining population the potential for growth is great with a lot of 'young' people entering the country.

On the other hand, there may be pressure on existing jobs, breeding resentment and possible tension between groups, particularly if the economic situation changes. The potential for large families in the future amongst this population could create pressure on social provision such as schools and health care.

Answers should refer to the issues that can be inferred from the population structure rather than simply problems associated with immigrants in receiving countries. At least 2 or 3 developed points, credit examples if given. Max 3 if just 'listy'.

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### Settlement Dynamics

6 Figs 5A and 5B show the population in urban areas in 1975 and 1995, and predicted for 2015. Fig. 5A is percentage urban population and Fig. 5B is total urban population (millions).

(a) (i) What percentage of the population in LEDCs lived in urban areas in 1975? [1]

27%

(ii) Use the data in Figs 5A and 5B to describe the differences between the numbers living in urban areas in MEDCs and LEDCs. [3]

MEDC's – overall higher %, but lower numbers (give data), smaller change between 1975 and 2015

LEDCs – lower %, but higher overall numbers (give data), change in % terms is greater. Candidates should use the data from both graphs and refer to both LEDCs and MEDCs, with an element of difference. Max 2 if insufficient data/not used both Figs.

(b) Name the processes that lead to an increase in the numbers of people living in urban areas in LEDCs. [2]

Two processes need to be named – rural-urban migration and natural increase of people living in the urban area would be the main ones expected.

(c) Suggest why there is a small percentage increase in urban population in MEDCs. [4]

MEDCs may be viewed as having reached a 'peak' in urbanisation, apart from a continued slow increase in larger cities. Movements may be between urban areas or within urban and also away from urban areas. Also natural increase will be mostly insignificant in MEDCs, leading to a lower increase in urban populations.

Suggest mark as 2/3 developed points.



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## Section B

### Hydrology and fluvial geomorphology

- 7 (a) (i) Define the fluvial terms *traction* and *suspension*. [4]

Traction is a means of the transportation of sediment such that larger load (e.g. pebbles or cobbles) are rolled or pushed along the stream bed by the current.

Suspension is sediment transportation whereby light sediments (grains etc.) are suspended above the bed by the current.

- (ii) Briefly explain the differences between laminar and turbulent flow in a river channel. [3]

Laminar flow is a low velocity smooth slab like flow over smooth surfaces or where the channel is deep. Turbulent flow is a series of rapid eddies caused by channel roughness. Could effectively be shown as diagrams.

- (b) With the help of diagrams, explain how river erosion can produce waterfalls and rapids. [8]

In the case of a waterfall a layer of more resistant rock overlies less resistant strata with the resultant plunge pool. The back wall and the plunge pool are being eroded by cavitation (implosion of air bubbles in the churning water). The headward erosion is produced by the erosion of the less resistant rock by cavitation and hydraulic action (in the joints and cracks) which eventually produces an overhang undercutting the more resistant rock leading to the retreat headward of the water fall. Rapids are produced over outcrops of resistant rock that often bring about a steepening of the channel slope, increasing turbulence and hence erosive capacity.

Max 5 marks if only 1 landform.

- (c) Describe how river floods occur. To what extent can the occurrence of floods be predicted and their effects limited? [10]

River floods occur due to an overbankful level of discharge leading to the inundation of surrounding areas, notably flood plains. This is due to a sudden excess of input in terms of precipitation. This can be a sudden event, such as a storm or cyclone or a seasonal event such as the melting of snows (nival flooding). The effects can be exacerbated by human activities such as deforestation or urbanisation, but these are rarely causal. Prediction is usually conducted through recurrence intervals or by catchment modeling through the agency of satellite photography. Neither is particularly effective in giving long term or accurate flood prediction. Short term prediction (an hour or two) can be achieved by monitoring approaching rainfall events within the catchment area. By far the most effective means of mitigating flood effects is to control discharge in the river. This is achieved by damming. In extreme events (e.g. Queensland, Pakistan) even this may prove ineffective as water has to be released from the dammed reservoirs. Raising levées and channel straightening, etc have proved of limited defence against flooding. Restricting activities on flood plains and controlling land use changes within catchments can have some impact but will not limit the impact of major rainfall events.

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### Level 3

Good appreciation of how floods occur and the means employed to predict them. Assessment made of the success of both prediction and attempts to control discharge.

[8–10]

### Level 2

Flooding seen as an overbank flow of water with a more limited view of prediction. Most will be on hard engineering attempts at flood control with very limited assessment of their effectiveness.

[5–7]

### Level 1

Flooding as a result of human activities. Little prediction and flood control largely seen in terms of changes to channel environs.

[0–4]

## Atmosphere and climate

- 8 (a) (i) Briefly explain the atmospheric terms *high pressure* and *low pressure*. [4]

High pressure is an area of descending air (high level convergence) that increases pressure (isobars) at the surface.

Low pressure is an area of ascending air (often associated with convectional heating) and hence low pressure (isobars) at the surface.

- (ii) How do high and low pressure areas affect wind direction? [3]

Winds at the surface blow towards areas of low pressure as the rising air is replaced. High pressure is the opposite with sinking air blowing outwards at the surface. Hence winds are seen as blowing from high to low pressure areas.

- (b) With the help of a diagram, explain the pattern of radiation excesses and deficits on the Earth's surface. Describe one way in which the transfer of heat from areas of excess to deficit occurs. [8]

Due to the impact of solar radiation of the overhead sun at the tropics and equatorial areas and the greater curvature of the earth and extent of atmosphere at the poles, more solar radiation is received at the earth's surface between the tropics than at the polar areas. This can be shown as simple diagrams showing the effects of the greater surface areas and the earth's tilt. Distance from the sun is not significant. Methods of heat transfer are either atmospheric through winds induced by the tri-cellular model producing pressure belts and surface winds or through the agency of ocean currents. Poleward flowing warm currents and equator-wards cold currents influence the temperatures of the air above them.

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**(c) Why is it important to understand the nature of greenhouse gases and how they can affect global warming? [10]**

Basically because greenhouse gases are the key to understanding the greenhouse effect which in turn allows an explanation of global warming. Greenhouse gases principally comprise water vapour, carbon dioxide and methane. These allow incoming short wave solar radiation to pass through them but are very effective in trapping outgoing long wave terrestrial radiation. This allows the earth's atmosphere to warm. Without this life on earth could not exist. The importance of greenhouse gases is in their possible increasing influence due to rising levels of carbon dioxide and methane. More heat is retained in the earth's atmosphere and hence a global rise in temperatures. It is suggested that the rise in carbon dioxide and methane levels is due to human activities in the burning of fossil fuels and the extension of agriculture. There is room for global warming skeptics to argue a case but this is not necessary for the marks. The effects of global warming needs discussing and why it is important to understand.

**Level 3**

Comprehension of greenhouse gases and their role in inducing the greenhouse effect. This will be linked to global warming and hence the importance of greenhouse gases demonstrated. **[8–10]**

**Level 2**

Some awareness of greenhouse effects and gases and global warming. More emphasis on the assumed disastrous effects of global warming. **[5–7]**

**Level 1**

Mostly effects of global warming with little on the mechanisms of its production. **[0–4]**

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## Rocks and weathering

- 9 (a) (i) Define the terms continental plate and oceanic plate. [4]

Continental plates are tectonic plates that carry the continents. They are on average about 33 km thick but the sial is less dense than oceanic plates.

Oceanic plates are tectonic plates under the ocean. They are c16 km thick but comprise of young sediments and basaltic lavas that are denser.

- (ii) Briefly describe the formation of a mid-ocean ridge. [3]

At divergent plate margins caused by convection currents in the mantle, magma is extruded to form parallel ridge like features. A well annotated diagram would suffice.

- (b) With the help of a diagram, explain the formation of landforms at the destructive plate margin formed by the meeting of two oceanic plates. [8]

The diagram should show the meeting of two oceanic plates where the thicker (or denser) of the two is subducted below the other. This produces melting in the benioff (subduction) zone and the rising of magma through the thinner plate to produce island chains (island arcs) of volcanoes. At the junction of the plates where subduction begins the crust is forced downwards to form deep ocean trenches. Much can be achieved through a well annotated diagram.

- (c) Describe the physical factors that can make a slope become unstable. To what extent can human activities affect slope stability? [10]

Slope stability is a function of the composition of the slope, its angle, and the physical factors that are affecting it. Thus geology has a role to play in terms of shear strength and alternate band of resistant and less resistant materials. External factors such as climate, weathering and erosion will all impact upon stability and can produce slides (along slide planes), flows (saturation) or heaves (freeze/thaw). Tectonic activity can provide a vital trigger to movement on slopes. Human activities can effect slope stability through overloading the slope (waste, reservoirs) undercutting the slope (roads, quarrying, mining) vegetation removal (deforestation), cultivation (ploughing). Generally, however, these serve to accentuate slope instability rather than being the only cause.

Human activity can also make slopes more stable.

### Level 3

Good understanding of the factors that affect slope instability including shear strength and stress and water pressure, etc. Human activities illustrated but assessed against physical factors. [8–10]

### Level 2

Some indication of the impact of climate and rock structure but only vaguely linked to slope stability. A range of human influences, but little indication of comparative scale. [5–7]

### Level 1

Instances of slope instability, such as landslides and mud flows, with little appreciation of cause. A list of human activities without much explanation of slope instability. [0–4]

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### Section C

#### Population

10 Fig. 6 shows the 'S' curve that models how population may change over time.

- (a) (i) Give the meaning of the term carrying capacity. [3]

The optimum number of people (1) that can be sustained (1) by an environment and its resources (1), at a given level of technology.

- (ii) Suggest reasons why the population may level off as it reaches the carrying capacity. [4]

Factors could include the negative feedback elements (natural checks) such as overcrowding leading to disease, inadequate food supply, limited water supply, etc. All resulting in lower rates of population growth, hence the levelling off of the graph. If it is recognised that the model applies to a particular area/region, then out-migration leading to a reduction in numbers is also acceptable. The role of government policies is also acceptable.

- (b) Outline the main features of underpopulation and consider whether underpopulation is a useful concept. [8]

Two main parts to this question, which may warrant a 5/3 split. The main features of underpopulation should be addressed, ideally with reference to examples (give credit) but this is not asked for. The second part of the question is looking for candidates to question underpopulation as a concept.

Underpopulation usually occurs where the environment has the potential to support a greater population than it currently does. It may be an area awaiting development (e.g. remote areas of Australia, Siberia) or an area that has lost population to more attractive areas. It may be recognised that for the latter reason, one of the features may be low economic output, leading to economic growth that can not sustain the population. Features may include low population densities, low or negative rates of urban growth, poor or declining infrastructure, poor communications, high rates of out-migration, poor access to health/social services.

As a concept underpopulation is open to a variety of interpretations, what is considered to be underpopulation in some areas may not be seen as such in others, depending upon the perception of the society and their resource needs.

- (c) Assess the success of attempts to sustain an increasing population using technology and innovation. [10]

The problem of overpopulation, in a conventional sense, implies an inadequate supply of resources for a population. This may be either due to population growth or diminishing resources. Attempts to overcome this are well-documented and candidates should be able to draw on a range of examples to exemplify their answers. Resources can include food, water, energy, land/habitat. Innovations such as bio-technology, irrigation, extraction, biofuels, renewables. It is also acceptable to discuss policies to encourage out-migration as a way of reducing pressure. There must be an element of evaluation, in that not all attempts have been successful, or that there have been serious costs involved.

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### Level 3

A detailed and perceptive answer that provides appropriate exemplification and evaluation of the success of the innovations used. [8–10]

### Level 2

Provides a good understanding of how the issues of overpopulation have been tackled, but may have a limited evaluation of the broader implications. [5–7]

### Level 1

Limited understanding of overpopulation, goes little beyond improving agriculture and no evaluation. [0–4]

## Migration

11 (a) (i) Give the meaning of the term *intra-urban migration*. [2]

Permanent (more than 1 year) movement of people (1) within an urban area (1), not commuting.

(ii) Describe and explain two types of intra-urban migration. [5]

Most common types of intra-urban migration may be suburbanisation, people desire more space, etc, they begin to move out of central areas to the edges of the urban space, often in steps, according to stage in the life-cycle.

There may be a reverse movement of young and more mobile populations, moving from the suburbs to the centre, seeking lifestyle, proximity to work, etc. (acceptable as a second situation)

There may be other examples of resettlement schemes within an urban area, observable in both LEDCs and MEDCs as governments may tackle the problem poor housing with new housing areas, sometimes on the fringe of the city. Two situations described and explained, credit examples. Max 3 if only one situation described.

(b) Using one or more examples, explain how push factors and pull factors cause internal migration.

Answers could focus on rural-urban migration, urban-urban or movement of refugees or migration to frontier/development areas. It may be a historical movement, especially if using an MEDC example, but is more likely to be LEDC. Must be an internal movement, probably on a regional scale and must refer to an example(s). Max 4 if no example used.

Indications of quality will be the level of detail in the example and the way it is used to exemplify the push-pull mechanism. In the case of refugees (forced migration) the push factor will far outweigh the pull.

The actual push/pull factors will depend upon the example chosen, but may include  
 Environmental disaster/civil war/political upheaval – refugees  
 Longer term environmental degradation leading to reduced income/poverty  
 Low income vs perceived higher income in urban areas (informal/formal)  
 Poor services (education/health) vs perceived better services in city  
 Opportunity for development/landowning – frontier regions (income)

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- (c) 'The social and economic impacts of internal migration are as important in source areas as in receiving areas'.

**How far do you agree with this view?**

**[10]**

The recognition that migration has a significant impact on both the source and receiving area lies at the heart of this question. To evaluate this assertion fully, candidates will need to outline the impacts of migration on both and give detail as to their relative importance. An understanding that 'impact' can be both positive and negative, depending on the nature of the migrants, and that this will vary spatially and temporally.

This is not a comprehensive list, but may indicate some of the impact of migration that may be covered.

Receiving – adds to population growth, adding to reproductive sector (esp. if low/less skilled), but may lead to overpopulation/population pressure  
introduce new skills/culture, but may lead to conflict  
valuable labour source, especially in shortage areas, possible informal sector  
strain on social services (health, housing, education)

Source – may relieve population pressure, but could lead to loss of productivity  
if skilled population leaving, shortage of educated/technical labour  
loss of family structures/community/culture  
introduction of new values via feedback from migrants  
remittances may improve family income

**Level 3**

A detailed and well balanced answer that looks at both sides and makes a well-exemplified evaluation. **[8–10]**

**Level 2**

A reasonable attempt to look at the impact on both areas, some detail and a good understanding of the issues. Lacks balance and limited evaluation. **[5–7]**

**Level 1**

A basic answer with little attempt to evaluate and with little knowledge of the impact of migration. Lists and basic description lie here. **[0–4]**

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## Settlement Dynamics

### 12 (a) Outline the problems faced by people living in shanty towns (squatter settlements) in LEDCs. [7]

A variety of answers are possible for this question, ranging from problems associated with the built environment to social problems. Candidates may base their answer on an example they have studied or they may approach it in a more general way. Either is acceptable. Mark on quality and detail. The following is not comprehensive:

- Poor quality building materials, high density dwellings on unsuitable surfaces (steep, unstable, flood prone, etc.)
- Lack of access to utilities (water, sewage, electricity) – disease prone
- Illegality may mean dwellings are removed/uncertainty
- Criminality/lack of law enforcement
- Poor access to social provision (not restricted to shanty towns)
- Poverty

### (b) Compare and explain the locations of low-income households in the cities of LEDCs and MEDCs. [8]

An attempt to compare the possible locations must be evident. Some candidates may refer to theoretical models of urban areas (though not necessary for full marks) which show low income households in MEDCs near the centre and low income households in LEDCs on the outskirts. A reasonable attempt to explain this will be acceptable, and would be worthy of 5/6 marks. A recognition that there are exceptions to the generally accepted patterns according to local circumstances/planning policy, etc may be an indicator of quality. Candidates should explain and attempt to compare, not just describe. Max 4 if just description.

### (c) To what extent is government action the most important way of solving the problems of shanty towns (squatter settlements) in LEDCs? [10]

Candidates should be able to draw upon examples. The focus may be on the community vs local planning and the efficacy of self help/site and service schemes, or 'clearance', etc. The main thrust should be the way in which governments/city authorities have dealt with it and how this compares to locally developed action. The detail will depend upon the examples chosen and indications of quality will those candidates that successfully attempt the evaluation.

#### Level 3

An effective evaluation that is more than likely well exemplified and detailed. [8–10]

#### Level 3

A reasonable response that perhaps draws on rather general examples, but covers the main issues with an attempt at evaluation. Will probably dwell on the problems of informal settlements, rather than how they have been tackled. [5–7]

#### Level 3

A basic answer that is limited by description only and offers no valid evaluation. [0–4]