ANGLO-CHINESE JUNIOR COLLEGE
JC 2 Preliminary Examinations 2016

GEOGRAPHY
Higher 1

8812/01

Time: 3 hours

19 August 2016

READ THESE INSTRUCTIONS FIRST

Write your Centre number, index number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A
Answer **four** questions.
Section B
Answer **one** question in this section.
Section C
Answer **one** question in this section.
You are advised not to spend more than 1 hour 30 minutes on Section A.
The insert contains all the Figures, Tables, and Photographs referred to in the questions.
You should make reference to appropriate examples studied in the field or in the classroom, even where such examples are not specifically requested by the question.
Diagrams and sketch maps should be drawn whenever they serve to illustrate an answer.
The world outline map may be annotated and handed in with relevant answers.
You are reminded of the need for good English and clear presentation in your answers.
The number of the marks is given in brackets [ ] at the end of each question or part question.

On the **cover sheet** provided, include:

- Your name and index no.
- The question numbers of the question you have attempted in the boxes provided, and place the cover sheet as the top page over your answers.
- At the end of the examination, fasten all your work securely together as one bundle.

This document consists of 5 printed pages, including this cover page.
Insert 1 consists of 9 printed pages.

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[Turn Over

Section A

Answer **four** questions in this section.
Questions 1, 2 and 3 carry 12 marks and Question 4 carries 14 marks.
You should allocate your time accordingly.

Lithospheric Processes, Hazards and Management

1	**Photograph A shows one type of granite landform found in a temperate region. Photograph B shows one type of limestone landform found in a humid tropical region.**		
	(a)	**Identify each of the landform shown in Photographs A and B.** A : Tabular or temperate tor B: Cone or cockpit karst	**[2]**
	(b)	**Explain how geology and climate may influence weathering and erosional processes to produce the landforms shown in Photographs A and B.** A brief description of the main features of each landform is expected Role of geology & climate **Tabular or temperate tor** • Answer could be anchored using the concept of the periglacial theory • Joints and chemical composition of granite • Cuboidal joints guiding earlier phase of hydrolysis during warmer and wetter period • Ice age – periglacial climate – cuboidal joints → frost wedging, and also solifluction (erosional process) • Temperate climate – dominant process would be that of frost weathering **Cone or cockpit karst** • Answer could use the framework of landform development based on the surface solution or underground solution of limestone • Role of grid joints and master joints guiding the process of carbonation • Details of the process of carbonation • Enlargement joints and cockpits forming at intersection of joints • Cockpit could enlarge when several merge • Surface of conical hills channel water to the cockpit rapidly, leading to comparatively lower rates of carbonation and solution. • Cockpit locations – lowest point and thus water collects there an accelerated rates of carbonation occur • Esp high rates of carbonation due the tropical climate, ie, high rainfall and high temperature • Role of erosion is significantly lower compared to that of tower karst.	**[10]**

Hydrologic Processes, Hazards and Management

3 EITHER

Fig. 2A shows the annual hydrographs of two rivers, the Ock and the Lambourn in UK in year 2000.
Figs. 2B and 2C show the drainage basins and the drainage networks of River Ock and River Lambourn respectively.

(a) Compare the annual hydrographs of the two rivers shown in Fig. 2A, and, with the aid of Figs. 2B and 2C, discuss **two** natural factors that may account for the differences. **[6]**

(b) With reference to **one** type of human activity, explain how this may affect the hydrograph of River Lambourn. **[2]**

(c) Explain how you will carry out field investigation to obtain the river discharge of each of the two rivers. **[4]**

Lithospheric and Hydrologic Processes, Hazards and Management

4 EITHER

Fig. 4 shows the Strahkov's model of weathering. Photograph C shows a braided river.

(a) Define the term *basal surface of weathering* as shown in Fig. 4. **[1]**

(b) Describe the relationship between climate and the depth of regolith shown in Fig. 4. **[2]**

(c) Account for the differing depths of regolith between the semi-desert and desert climate and tropical rainforest climate. **[8]**

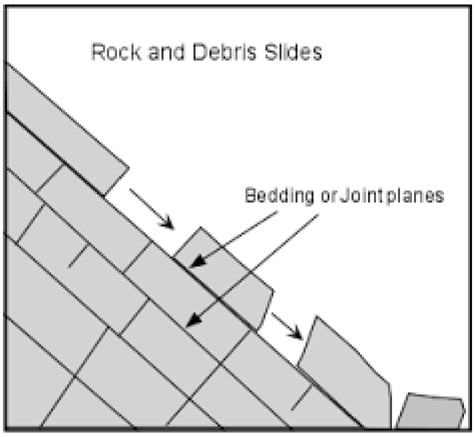
(d) With reference to Photograph C, explain how some of the fluvial features of the braided stream are influenced by the climatic factor. **[3]**

Answer **one** question in this section.

Lithospheric Processes, Hazards and Management

5 Either	**(a)**	**Describe and explain the nature of volcanic activity at destructive plate boundaries.** • Nature of destructive plate boundaries – Oceanic-continental type, and the oceanic-oceanic lithosphere plates convergence • Over-riding plate is either the continental one (lower density) or the young oceanic plate (lower density as well). • Brief details of the role of subduction, metamorphism, fractional crystallisation in the formation of silic or felsic lava to result in acidic lava	**[9]**

		• Main lava types – andesitic and rhyolitic types • High degree of explosiveness; eruption style could range from the milder one of strombolian, vulcanian to much more explosive ones like the pelean and the plinian types. • Ejected material could involve slow-flowing silicic lava, pyroclastic flow, ash fall and ash flow, • Could also result in volcanic ejecta mixing with waters in rivers or from melted snow → lahar or mudflow • Volcanic type according to form include composite cone, ash and cinder, scoria cone, volcanic dome	
	(b)	**How far do you agree that impacts of volcanic activities are largely determined by the accuracy of the prediction of the event?** **Content expected & approach** • An introduction that outline the intended approach, including delimiting boundary of discussion for key terms in in question: impacts and prediction. • Impacts on the physical and human environment should be explained through examples, and the nature of impacts and the severity of impacts are evaluated in relation to the accuracy of prediction. • The methodology of prediction which would include the various ways to monitor is outlined. • A top-level answer would have included the other ways to manage or mitigate the impacts (supported by relevant examples), and where there were varying degree of success; these could include short-responses (warning and evacuation, food, shelter, water, medical aid), and long-term responses of hard engineering (lava dams, barriers, etc). • It would also recognize that the nature of the volcanic eruption in terms of magnitude, nature of eruption style, nature of volcanic ejecta, level of preparedness of population, timing of eruption, can also influence the severity the impacts on both the physical and human environments. • A conclusion that will summarise and rank the factors that determine the nature and the severity of impacts, and that prediction is one of the many strategies to manage the impacts of volcanic hazards.	**[16]**

5 Or	**(a)**	With the aid of labelled diagrams, describe the nature of **two** types of mass movement. Any two of the following: **1. Rockslides** **Fig. 1**  **Nature of rockslides** • Rapid and sudden downward movements of rocks or boulders sliding along a steep slope (straight slide plane) • Rockslides are translational slide as the slide plane is straight. • In rockslide, the materials generally retain their coherence whilst moving across a clearly defined slide plane. • Rockslide moves “en masse” and is not affected by the internal derangement. The rock mass remains intact until it reaches the bottom of the plane where impact usually breaks it up. • Velocity is essentially uniform throughout the sliding mass in simple cases. **Conditions that increases likelihood of rockslides:** Geologic: • presence of bedding planes or jointing which are dipping downward • (increase in shear stress) and parallel to the slope (seaward/downward dipping) – to provide slide planes and downward dipping surfaces over which the detached masses can slide (most important condition) Climatic: • Heavy rainfall: Rockslides are often associated with the times of heavy rainfall – water, entering the joints and bedding planes, increases the pore pressure (decreasing the shear strength) while increasing the shear stress by adding weight. Water also provides lubricating effect,	**[9]**

accelerating the slope failure.

Tectonic (earthquake)

- The 1811 earthquake of New Madrid, Missouri, for example, caused slides in an area of more than 13000 sq km along the Mississippi River valley.
- Aug 17, 1959 earthquake that triggered a massive rockslide in the canyon of Montana's Madison River – vibrations lead to an increase in shear stress

2. Mudflows

Nature of mudflows

- Movement: downslope, less viscous flow – highly fluid, high velocity mixture of sediment and water that has a consistency ranging between soup-like and wet concrete – fluid due to more water content.
- Materials involved: saturated, fine-grained materials that include clay, fine sand and silt but due to its low viscosity, can aid in the movement of large boulders which glide over its surface. More than 80% of the material would be silt-sized (0.06mm) or smaller.
- Velocity: More rapid, less viscous and they move at velocities greater than 1 km/hr. In the case of the Nevado del Ruiz volcanic mudflow (lahar), it flowed at 45 km/hr.
- Mudflows can travel for long distances over gently sloping stream beds, and tend to travel along valley floors. Example: Lahar of the Nevado del Ruiz volcano (1985) travelled over 50 km to bury the town of Armero. Because of their high velocity and long distance of travel, they are potentially very dangerous.
- Location: Mud flows typically develop on much lower slopes than earthflows. They can be channelised flow.

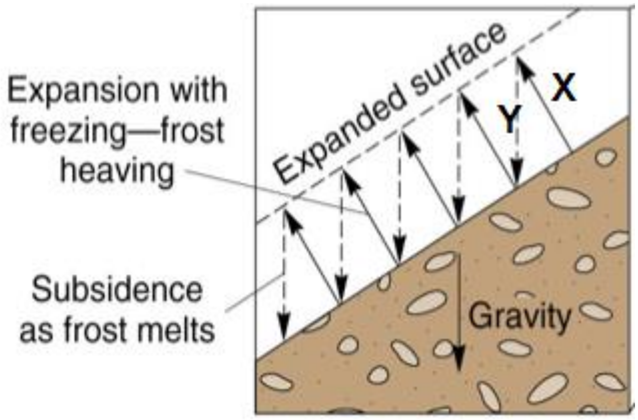
Causes of mudflows:

- Steep slopes – increase in shear stress due to gravity
- Geological conditions: Type of soil and rock – Thin soil lying over impermeable rocks. Materials susceptible to mudflow include clay, fine sand and silt. Mudflows are associated with landslides and slumps –with decrease in shear strength
- Climatic conditions – The mudflows occur most commonly in areas with very sparse vegetation cover and subject to sporadic torrential downpours. The exposed regolith rapidly becomes saturated (decrease in shear strength due to increase in pore water pressure and increase in shear stress due to addition of water), exceeds its liquid limit, and in effect becomes a viscous river. Mudflows in desert wadis have been reported up to 2 m thick and moving so fast that had waves on their surface. They have usually stopped on the lower angle slopes, where the water drains from the base of the flow into permeable regolith beneath. It can

also occur in humid regions when heavy rain falls on already saturated slopes.
- Sparse cover of vegetation – decrease in shear strength provided by the anchoring effects of vegetation
- Volcanic eruptions – Mudflows can also result from volcanic eruptions that cause melting of snow or ice on the slopes of volcanoes, or draining of crater lakes on volcanoes. Volcanic mudflows are often referred to as lahars. Some lahars can be quite hot, if they are generated as a result of eruptions of hot tephra.
- Broken bonds of clay minerals – Sometimes mudflows may start without the addition of water from any external source. If the bonds between clay particles are broken (decrease in shear strength), cohesion is destroyed, and the pore water reacts against reconsolidation of the separated particles, keeping the mass fluid.

Soil Creep

Fig. 3



Nature of soil creep:
- This refers to the slow, often not discernible downhill movement of soil particles or fine weathered materials under the influence of gravity.
- Creep takes a long time because each particle might only move a millimetre to a few centimetres at a time.
- The resultant slope may be covered with long narrow steps called terracettes.
- Rates of soil creep are faster at the surface, and progressively reduces to nil a short distance from the surface as frictional resistance increases with depth.

Mechanisms leading to soil creep:
- Expansion and contraction of the regolith – Expansion causes the surface of the slope to heave at right angles to the original surface and particles are lifted along the

		expansion path Y. Upon contraction, each particle is no longer supporting by its neigbouring particles, and gravity is the dominant force pulling the particle along the path Y. The net result is a downward movement of this particle on the slope. It is the gravity that always causes the rocks and soil to settle just a little farther downslope than where they started from. • Freeze-thaw – Freezing of saturated regolith sometimes produces a growth of ice needles perpendicular to the surface called pipkrakes. Simply, the process is one where the growth of ice crystals and ice needles beneath particles, lift these particles up at right angles to the slope, and they fall back perpendicularly under the influence of gravity when thawing occurs. • Freeze-thaw could also occur by the expansion of ice in the pore spaces between soil particles, and upon thawing, the particles are released further downslope was it settles downwards as shown in Fig. 3.	
	(b)	**To what extent can the effects of earthquake be mitigated?** Using some of the examples below, discuss that there are a range of factors that can affect how successful mitigation strategies of effects of earthquake are, and these include: • Physical factors: magnitude, timing – time of day, and time of year, geology, presence of precursors, • Human factors: level of community preparedness, population distribution and density, level of economic development in relation to use of high technology and hard engineering against earthquake hazards,	**[16]**

Example: <u>2004 Indian Ocean "Boxing Day" Tsunami</u>: The 2004 Indian Ocean earthquake, known by the scientific community as the great Sumatra-Andaman earthquake, was an undersea earthquake that occurred on December 26, 2004, with an epicenter off the west coast of Sumatra, Indonesia. The earthquake triggered a series of devastating tsunamis along the coasts of most landmasses bordering the Indian Ocean, killing large numbers of people and inundating coastal communities across South and Southeast Asia, including parts of Indonesia, Sri Lanka, India, and Thailand. Although initial estimates had put the worldwide death toll at over 275,000 with thousands of others missing, more recent analysis compiled by the United Nations lists a total of 229,866 people lost, including 186,983 dead and 42,883 missing. The magnitude of the earthquake was originally recorded as 9.0, but has been increased to between 9.1 and 9.3. At this magnitude, it is the second largest earthquake ever recorded on a seismograph. This earthquake was also reported to be the longest duration of faulting ever observed, lasting between 500 and 600 seconds (8.3 to 10 minutes), and it was large enough that it caused the entire planet to vibrate as much as half an inch, or over a cm

Example: <u>Tohoku, Honshu, Japan (11 March 2011) Mag. 9.0 Earthquake</u>: The 9.0 magnitude earthquake, 180 km off the Sendai coast of Japan (Fig. 30), caused a 10m height tsunami wave that devastatingly washed out large tracts of coastal land in the north-east coast of Japan. A tsunami wave that was 10m in height and raced 10 km inland in Sendai. The death toll to-date is **30,000**, many of which were the elderly. The tsunami resulted from the doming of the seawater due to the uplifting of the seafloor. The **thrust-faulting** of the Pacific Plate under the North America plate caused the uplift of the North American plate. The tsunami, besides inundating large tracts of land, pulverising infrastructure, levelling buildings and homes, also knocked down the diesel cooling system of the Fukushima nuclear power plant, leading to the failures of several nuclear reactors. This, in turn, has led to radioactive contamination of the coastal waters and the agricultural products of the region. The earthquake also caused land to subside on the mainland. Liquefaction of soil and sediments may also have caused settling. Many countries, including Singapore, have imposed ban on food products from the affected north-east region of Japan.

Example: <u>1970 Peru Earthquake</u>: The greatest mass movement disaster ever recorded occurred when an offshore earthquake (M=7.7) triggered a massive rock and snow avalanche from the overhanging face of Nevado Huascaran mountain, Peru on May 31, 1970. The resulting turbulent flow of mud and boulders buried towns and villages under debris 10 m deep and about 18, 000 people were killed less than four minutes after the original slope failure on the mountain. Rescue work was attempted with bare hands; no tools were available. Thousands of injured died because of the lack of help. Help, food, and medical supplies began to arrive after 48 hrs.

Example: <u>The Good Friday Earthquake, Alaska, 1964:</u> On Good Friday, 27 March 1964, at 5:36 PM, an earthquake of magnitude 9.2 struck Alaska which sits on the slab above the subducting Pacific plate, when a fault between the Pacific and North American plates ruptured. The earthquake lasted for three to five minutes in most areas. Ocean floor shifts created large tsunamis (up to 20 metres in height), which resulted in 122 deaths out of the total of 131 deaths and much of the property damage. Large rockslides were also created which resulted in great property damage. Vertical displacement of up to 11.5 m occurred, affecting an area of 250,000 km² within Alaska. Over 10,000 aftershocks were recorded following the main shock. In the first day alone, eleven aftershocks were recorded with a magnitude greater than 6.0. An additional nine more occurred over the next three weeks. It was not until eighteen months later that the aftershocks were no longer a danger

Example: <u>Paso Robles earthquake, California, 2003</u> – an example of positive human factors reducing the impacts

- However, less well reported was the identical earthquake that hit central California on 22 December 2003 at 1115 local time. Measuring 6.5 on the Richter Scale, it resulted in the deaths of only 3 people when a clock tower toppled over in the town of Paso Robles (population: 25,000).
- Three lives lost (and 40 badly injured) in a region where great attention is paid to architectural design along the San Andreas Fault.
- Within 12 hours, search and rescue crews in Paso Robles had combed all seriously damaged buildings and had found all the quake's victims.
- 82 downtown buildings were identified as having at least some damage. Flexible structures, light roofs, diagonal bracing (to prevent rhombohedral collapse of buildings) and careful land zoning regulations all contribute to minimal damage to the housing stock for all but the highest intensity earthquakes.
- Paso Robles' irreplaceable historic clock tower structure, sometimes called the Acorn Building, was destroyed. It was made of wood and un-reinforced masonry, a type of construction no longer allowed under modern building codes.
- About 75,000 homes and businesses in San Luis Obispo and Santa Barbara counties lost power after the quake, but service restored to all rapidly.
- Relatively high insurance recovery costs are anticipated for minor structural damage to the housing stock and airport.
- California uses a variety of both hard and soft engineering mitigation methods – effective mitigation

Example: Bam earthquake, Iran 2003

- On 26 December 2003, the town of Bam in Iran experienced an earthquake measuring 6.6 on the Richter Scale at 0510 local time.
- Lack of effective aseismic building design
- Around 28,000 already confirmed dead due to the immediate collapse of poorly-constructed multi-storey homes with heavy roofs. About 70% of the houses in Bam have been destroyed.
- Two of the city's hospitals have collapsed, crushing many staff, and remaining hospitals are full.
- Many of the city's buildings were made from mud-brick, which tends to disintegrate on collapse, meaning less chance of air pockets forming, in which people might survive. The residential buildings were completely inappropriate for a seismic region, being extremely vulnerable to earthquake shaking.
- The requirements of the Iranian Code of Practice for Seismic Resistant is not stringent
- Design of Buildings were ignored or not enforced for residential buildings.
- The foreshocks were not regarded as serious warnings.
- Relatively low property and life insurance costs compared with the US, although modern industry and an airport are sited in the special economic zone at Bam (Daewoo car seats are made here).
- Rapid pledging of aid from other countries so that re-building should be quicker than otherwise – hence what we see is that disaster aid is used as one of the major methods of mitigation by most LDCs.
- In the case of the Bam earthquake of Dec 2003, one of the contributing factors to the high death rates was the loss of medical facilities. The complete destruction of the local medical facilities meant that emergency assistance was not available to victims in the crucial hours immediately after the earthquake, and thus had a big impact on survival rates.
- Other factors that have contributed to the high casualties for the 2003 Bam earthquake:

Physical factors:

- Nature and direction of rupture: The Bam earthquake occurred not on the known fault line, but 5 km to the west and closer to the city of Bam. This created more intense shaking at Bam. The rupture started from the south and progressed northwards towards Bam. This directed the earthquake waves at the city.

Human factors:

- Timing of the rupture – 5.30am, people still asleep in their homes
- Cold winter time – sub-zero night-time temperature for those trapped in the rubble
- Poor structural integrity of the buildings; compromised by termite infestations
- Slow response of both the national and the international agencies

Example: Spitak, Armenia, 1988: The Spitak Earthquake also called Leninakan Earthquake was a tremor with a magnitude of 6.9 that took place on December 7, 1988 in winter at 11:41 local time (when people were either at work or in school) in the Spitak region of Armenia, then part of the Soviet Union. The Arabian plate is pushing into Eurasian plate at a rate about 4.5 cm per year, creating compression and shortening. In this earthquake, the surface of the Earth rose 2 m in a dominantly vertical and compressive movement as part of Armenia rode upward and onto the Arabian plate. Local housing infrastructure (particularly 83 schools and 84 hospitals) performed poorly in the earthquake and this resulted in 50,000 lost lives. The earthquake had killed or injured 80% of doctors and nurses just when they were needed most. The entire city of Spitak was destroyed, and there was partial damage to the nearby cities and villages. Since most of the hospitals in the area were destroyed, and due to freezing winter temperatures, officials at all levels were not ready for a disaster of this scale and the relief effort was therefore not launched properly. The Armenian government let in foreign aid workers to help with the recovery in the earthquake's aftermath for the first time. **Many factors contributed to the magnitude of the disaster, including freezing temperatures, time of day, soil conditions, and inadequate building construction.**

Example: <u>Tangshan, China, 1976</u>: A deadly earthquake took place directly beneath the city of Tangshan when a fault ruptured at a depth of 11 km in a local response to the regional stress created by the on-going collision of India with Asia. The earthquake was much larger than the local officials expected. Two factors were responsible for 6,500 deaths; the time of earthquake which was at night at 3:42 AM and poor building codes and building design.

Hydrologic Processes, Hazards and Management

6 Either **(a)** What are the causes of river floods? **[9]**

(b) With reference to examples, evaluate the effectiveness of methods used to mitigate the effects of river floods. **[16]**

6 Or **(a)** With the aid of one or more diagrams, describe and explain the processes of erosion in a river channel. **[9]**

(b) ‘Human interventions in the catchment are the cause for conflicts in the management of transborder river basins.’

Assess the validity of this statement. **[16]**