2021 USGC Nationals Written Examination - Key and Marking Scheme

Section 1 [25 marks]

1. What country does this data represent? [3 marks]

Given the available information, answer the following questions [1 mark per question] –

2. Which of the following best characterizes this country's total fertility rate as of 2019? (6 or above, between 5 and 5.9, between 4 and 4.9, between 3 and 3.9)
3. Which of the following best characterizes the average life expectancy in this country? (just under 45 years, between 50 and 55 years, just under 60 years, over 65 years)
4. Which of the following best characterizes this country's current per capita GNI? ($400, $500, $600, $700, $800)
5. In which stage of Rostow's stages of economic growth is this country? (traditional, preconditions for take-off, take-off, drive to maturity, high mass-consumption)
6. Which of these best describes this country's HDI score as of 2020? (below .4, between .5 and .549, between .6 and .649, above .7)
7. In which stage of the demographic transition model is this country? (1, 2, 3, 4, 5)

8. Using specific evidence from the documents provided, explain why you placed this nation in that particular stage of the demographic transition model. [3 marks]

9. Define the term Gender Inequality Index. What three factors are considered when calculating this measure? [4 marks]
10. Would this country have a high or low level of gender inequality? Explain your answer using evidence from the documents. [3 marks]
11. What are some specific policies the government of this country might enact to alleviate the problem of gender inequality? What are some specific steps that might be undertaken by corporations, private charities, or NGOs to achieve this goal? [6 marks]

Grading notes: Questions 1-7 are point marked, questions 8-11 are level marked.

Expected answers:

1. [3 marks] Niger

Q 2-7 [1 mark per answer]

2. 6 or above; 3. just under 60 years; 4. $600; 5. preconditions for take-off; 6. below .4; 7. stage 2

8. [3 marks] reliance on subsistence agriculture, high poverty rates, falling death rates drop due to improvements in food supply and sanitation, which increase life expectancies and reduce disease, numerous improvements in public health reduce mortality, especially childhood mortality

9. [4 marks] index for measurement of gender disparity, it is a composite measure to quantify the loss of achievement within a country due to gender inequality; three factors - reproductive health, empowerment, and labor market participation

10. [3 marks] high; factors such as very high TFR, low female literacy, reliance on subsistence agriculture, low GDP could all be considered [other reasonable answers accepted]

11. [6 marks] reasonable public policy goals that could be accomplished by the government of a developing country would be considered, including increasing funding for public education and healthcare, especially in rural parts of the country, specific educational programs targeting women (including information about family planning techniques and reproductive health), and economic reforms; second part of this question should fall into the same categories – reasonable and achieveable goals that could be accomplished by these groups, including things like economic development, microloan programs, etc. [accept reasonable answers for all parts and award liberal partial credit]

Section 2 [25 marks]

12. Define the term karst. [2 marks]

13. Which of these are karstic regions? Select all that apply. (Nullarbor Plain, Australia; Tham Luang Nang Non, Thailand; Stone Forest, China; Ha Long Bay, Vietnam; Texas Hill Country, United States; Yosemite Valley, United States; Novosibirsk, Russia; Davis Highlands, Canada; Patagonia, Argentina) [5 marks]

14. Match each of the following landforms and features to the corresponding number on the diagram. (disappearing stream, cavern, karst tower, polje, karst cone, limestone pavement, uvala, resurgent stream, doline) [9 marks]

15. Briefly explain the connection between karst topography and petroleum geology. [2 marks]
16. Briefly explain one difficulty farmers might encounter in karst areas. [2 mark]
17. Briefly explain how karst topography might affect water supplies in wells and aquifers. [2 marks]
18. Define the term uvala. [3 marks]

Grading notes: Questions 12 and 15-18 are level marked, questions 13 and 14 are point marked.

Expected answers:

12. [2 marks] a topography formed from the dissolution of soluble rocks such as limestone, dolomite, and gypsum. It is characterized by underground drainage systems with sinkholes and caves. [accept reasonable equivalents]

13. [1 mark per correct answer] Nullarbor Plain, Australia; Tham Luang Nang Non, Thailand; Stone Forest, China; Ha Long Bay, Vietnam; Texas Hill Country, United States

14. [1 mark per correct answer] disappearing stream - 3, cavern - 11, karst tower - 7, polje - 13, karst cone - 8, limestone pavement - 5, uvala - 4, resurgent stream - 10, doline - 1

15. [2 marks] study of paleokarst (buried karst in the stratigraphic column) is important in petroleum geology because as much as 50% of the world's hydrocarbon reserves are hosted in carbonate rock, and much of this is found in porous karst systems [accept reasonable equivalents]

16. [2 marks] because karst areas are so porous soils have poor water retention which complicates farming even in the presence of adequate rainfall; issues with groundwater pollution and sinkholes can also be problematic for farmers [accept reasonable equivalents]

17. [2 marks] Water supplies from wells in karst topography may be unsafe, bypassing the normal filtering that occurs in a porous aquifer. Karst formations are cavernous and therefore have high rates of permeability, resulting in reduced opportunity for contaminants to be filtered. Groundwater in karst areas is just as easily polluted as surface streams. [accept reasonable equivalents]

18. [3 marks] large (in km scale) karst closed depressions of irregular or elongated plan form resulting from accelerated corrosion along major tectonically broken zones; a closed karst depression, a terrain form usually of elongated or compound structure and of larger size than that of sinkholes (dolines) [accept clear-knowledge equivalents, but must distinguish size in order to receive full marks]

Section 3 [25 marks]

19. In a well-developed paragraph and with as much detail as possible, explain the impact of railroad expansion on the economy of the United States in the period from 1870 to 1920. [12 marks]

20. In a well-developed paragraph and with as much detail as possible, explain the impact of highway construction on the economy of the United States in the period from 1950 to present. [13 marks]

Grading notes: Both questions are level marked; answers must be in the form of a well-organized paragraph with specific examples to receive full marks

Expected answers:

19. a wide variety of acceptable answers are possible, but should include the reduced cost and increased reliability of rail transport of goods and the increased availability of raw materials for manufacturing; other examples could include the growth of corporations and large-scale manufacturing, the growth of cities and early public transportation, the opening of Western markets, the growth of railroad cities and many others; specific details should be included for full marks

20. a wide variety of acceptable answers are possible, but should include increased reliance on automobiles and long-haul trucking for transportation and movement of goods and the increased suburbanization brought about by highway construction; many other examples are possible; specific details should be included for full marks

Section 4 - [25 marks]

Please refer to the image in section 4 of the Resource Booklet.

21. Define the term P-wave. [2 marks]
22. Define the term S-wave. [2 marks]
23. Identify 3 main differences between P-waves and S-waves. [3 marks]
24. Define the term surface wave. [2 marks]
25. Briefly identify the main differences between surface waves and body waves. [2 marks]

26. Given the information in the map of the 2016 Ecuador earthquake, briefly explain the cause of this event, including the plates involved and type of earthquake that would occur at this boundary. Be as specific as possible. [7 marks]

27. What is the seismic intensity scale generally used in the United States to measure earthquakes? [1 mark]
28. What is the seismic magnitude scale used to measure earthquakes in the United States? [1 mark]
29. Based on that scale, how intense was the 2016 Ecuador earthquake at its strongest? [1 mark]
30. What was the corresponding magnitude of the 2016 Ecuador earthquake at its strongest? [1 mark]

31. What are three ways the Ecuadorian government could seek to mitigate damage from future major earthquakes? [3 marks]

Grading notes: Questions 21, 22, 24-26 and 31 are level marked; all others are point marked

Section 4 (continued)
Expected answers:

21. [2 marks] one of the two main types of elastic body waves, called seismic waves in seismology. P waves travel faster than other seismic waves and hence are the first signal from an earthquake to arrive at any affected location or at a seismograph. P waves may be transmitted through gases, liquids, or solids. [accept reasonable equivalents]

22. [2 marks] a type of elastic wave and are one of the two main types of elastic body waves, so named because they move through the body of an object, unlike surface waves. S waves are transverse waves, meaning that the oscillations of an S wave's particles are perpendicular to the direction of wave propagation, and the main restoring force comes from shear stress. Therefore, S waves cannot propagate in liquids with zero (or very low) viscosity; however, they may propagate in liquids with high viscosity [accept reasonable equivalents]

23. [1 mark per correct answer] p-waves are faster than s-waves; p-waves are longitudinal, s-waves are transverse; p-waves can travel through any medium, s-waves cannot travel through gases or most liquids [other reasonable answers may be accepted]

24. [2 marks] Seismic surface waves travel along the Earth's surface. They can be classified as a form of mechanical surface waves. They are called surface waves, as they diminish as they get further from the surface. They travel more slowly than seismic body waves (P and S). In large earthquakes, surface waves can have an amplitude of several centimeters. [accept reasonable equivalents]

25. [1 mark per correct answer] surface waves are slower than both p- and s-waves; surface waves travel on the surface of the earth, body waves through the interior; particle motion in surface waves is larger so they cause more damage than body waves [accept reasonable equivalents]

26. [7 marks] answers may vary slightly but must include the following for full marks – severe thrust (or megathrust) earthquake caused by a rupture in the interface between the Nazca Plate and the South American Plate or by the subduction of the Nazca Plate beneath the South American Plate [accept reasonable formulations with the correct information, award partial credit where necessary]

27. [1 mark] Modified Mercalli Scale
28. [1 mark] moment magnitude scale
29. [1 mark] VIII
30. [1 mark] 7.8

31. [1 mark per correct answer] a wide variety of answer are acceptable here, including detection and early warning systems, changes to building codes and construction methods and various emergency preparedness strategies; credit will be given for reasonable public policy solutions that would be achievable by the government