

ROYAL CIVIL SERVICE COMMISSION
CIVIL SERVICE COMMON EXAMINATION (CSCE) 2008
EXAMINATION CATEGORY: TECHNICAL

PAPER III: SUBJECT SPECIALIZATION PAPER for GEOLOGY

Date : 20/12/08
Total Marks : 100
Examination Time : 2.5 hours
Reading Time : 15 minutes

This paper is divided into two sections A and B has 7 pages.

Section A contains:

- a) 30 multiple choice questions of one mark each (30 marks)
- b) 4 short answer questions of 5 marks each (20 marks)

Section B:

Contains two case studies and candidates are required to attempt one question (50 marks)

Please write all your answers in the Answer sheets/booklet provided to you.

SECTION A

Question 1: Multiple Choice (30 marks).

1. Polymorphs of Al_2SiO_5 are:

- a) kyanite, andalusite, and sillimanite
- b) calcite, aragonite, and dolomite
- c) biotite, muscovite, and phlogopite
- d) none of the above

2. Quartzite is a:

- a) sedimentary rock
- b) igneous rock
- c) metamorphic rock
- d) none of the above

3. The average thickness of the continental crust is:


- a) 10 km
- b) 20 km
- c) 30 km
- d) 40 km

4. Vesicles:

- a) are produced by a slow rate of magma cooling
- b) occur only in pyroclastic rocks
- c) occur only in lavas
- d) are produced by degassing of magma

5. Pumice is:

- a) are produced by a slow rate of magma cooling
- b) a highly vesicular igneous rock
- c) characteristic of non-explosive volcanic activity
- d) a textural term referring to the absence of vesicles

6. The symbol  is used to depict:

- a) lineation
- b) foliation
- c) bedding
- d) none of the above

7. The symbol  is used to depict:

- a) lineation
- b) foliation
- c) bedding
- d) none of the above

8. The Himalaya is the type-example of:

- a) oceanic-continental collision
- b) oceanic-oceanic collision
- c) continental-continental collision
- d) none of the above

9. The presence of slickensides in the field would indicate:

- a) a fault
- b) jointing
- c) a syncline
- d) an anticline

10. In a normal fault, the hanging wall:

- a) moves horizontally relative to the foot wall
- b) moves downwards relative to the foot wall
- c) does not move relative to the foot wall
- d) none of the above

11. The "age of the dinosaurs" refers to the:

- a) Ordovician
- b) Permian
- c) Jurassic-Cretaceous
- d) Tertiary

12. Unit of the grade of mineral is:

- a) gram/cm^3
- b) kilogram/m^3
- c) both a) and b)
- d) none of the above

13. Which is the youngest geological period?

- a) Permian
- b) Cambrian
- c) Silurian
- d) Devonian

14. CaCO_3 is a chemical formula for the mineral:

- a) gypsum
- b) talc
- c) quartz
- d) limestone

15. Key factors determining metamorphism are:

- a) pressure, temperature, and composition
- b) grain size and crystal structure
- c) enthalpy and entropy
- d) none of the above

16. The term foliation is applied to a:

- a) sedimentary rock
- b) metamorphic rock
- c) igneous rock
- d) none of the above

17. The correct order of increasing hardness is:

- a) calcite, fluorite, apatite, orthoclase
- b) orthoclase, apatite, fluorite, calcite
- c) apatite, fluorite, orthoclase, calcite
- d) none of the above

18. $\text{N}30^\circ\text{W}$ is same as azimuth:

- a) 270°
- b) 330°
- c) 030°
- d) none of the above

19. The India-Asia collision began about:

- a) 50 million years ago
- b) 40 million years ago
- c) 30 million years ago
- d) 20 million years ago

20. On Mohs' scale, hardness of a mineral calcite is:

- a) 5
- b) 2
- c) 3
- d) 4

21. The index mineral of a green-schist facies rock is:

- a) sillimanite
- b) kyanite
- c) amphibole
- d) chlorite

22. The age of the Earth is approximately:

- a) 4.6 Ma
- b) 4.6 Ga
- c) 4.6 ka
- d) 15 Ga

23. A sedimentary rock composed of rounded grains with an average size of 3 mm is:

- a) breccia
- b) conglomerate
- c) sandstone
- d) mudstone

24. The concept that rocks at the bottom of a sedimentary sequence are the oldest is the basis for:

- a) the principle of original horizontality
- b) Newton's law of gravity
- c) the principle of superposition
- d) the principle of inclusions

25. The principle of cross-cutting relationships states that, if rock A cuts across the boundaries of rock B, then:

- a) A is older than B
- b) B is older than A
- c) A and B are of the same age
- d) no conclusions about the relative age can be made

26. The principle of inclusions states that, if a fragment of rock A is included in another rock B, then:

- a) A is older than B
- b) B is older than A
- c) A and B are of the same age
- d) no conclusions about the relative age can be made

27. Biotite is an example of:

- a) sheet silicate
- b) single chain silicate
- c) double chain silicate
- d) framework silicate

28. The Mn-endmember mica is:

- a) biotite
- b) muscovite
- c) phlogopite
- d) none of the above

29. Two popular tectonic models invoked to explain the Himalayan orogenesis are:

- a) Channel flow and critical taper
- b) Pop-up and Faulting
- c) Spreading and transform tectonic boundaries
- d) none of the above

30. Lithosphere is a rheological unit and includes:

- a) lower mantle and upper mantle
- b) upper mantle and lower crust
- c) lower mantle and outer core
- d) outer core and inner core

Question 2:

- i. Briefly mention how would you map a fault in the field?
- ii. Differentiate reserve and resource.
- iii. Explain the terms strain and deformation?
- iv. Write three distinguishing features of igneous and metamorphic rocks.

SECTION B: Case Study

This section contains two questions. You are required to attempt only one of them (50 marks).

Case Study 1

You are assigned as a principal investigator of quartzite exploration project in southern Bhutan mainly within Shumar-Daling and Baxa Formations. The main aim of this project is to map chemical grade quartzite and calculate the reserve necessary to sustain the Ferro Silicon plants at Pasakha. What are some of the things you need to do before the fieldwork? While in the field, how will you start the work? Outline and explain the stages of mineral exploration keeping quartzite as a target mineral? And mention when to abandon the exploration work. Where necessary, please illustrate with diagrams. Pretend that you have quartzite analytical results – say the result shows average silica content of 98%. Consider the cost of transportation. It may not be economic if the mining site is far from the processing plant.

Imagine you are submitting the final report

Introduction

Location

Regional Geology

Geology of the Area

Analytical Result

Probable reserve

- Mapping – produce geologic map i.e. tracing the band, measure thickness and strike length)
- Geologic cross-section for interpreting the down-dip continuity
- Grade of quartzite
- Estimate tonnage

Conclusions and recommendations (here you can justify whether to continue with the next stage or to abandon completely)

OR

Case Study 2

Like other parts of the Himalaya, Bhutan is known for its scenic beauty owing to the presence of some of the highest mountains in the world. Mountains, the result of the continental-continental collision, are still rising and because of this the people of Bhutan are facing unprecedented natural (geologic) hazards. While mountain building processes raise the elevation, the forces (rivers and glaciers) of erosion lower the elevation. Landslides and mudflows are the manifestations of erosion which destabilize the area. When landslides occur in the steep mountainous terrain, they can temporarily dam rivers, making lakes. Catastrophic floods and debris flows occur when these dams burst causing enormous damage to lives and property downstream.

Considering all these, write an essay on how you would assess for natural hazards such as earthquakes, landslides, flash floods, and glacial lake outburst floods.

Imagine you are submitting the final report

Introduction

Location

Regional Geology

Geology of the Area

Analytical Result

Methodology

- Mapping – produce geologic map i.e. tracing the band, measure thickness and strike length)
- Geologic cross-section for interpreting the down-dip continuity
- Observation

Conclusions and recommendations (here you can justify whether to continue with the next stage or to abandon completely)