ROYAL CIVIL SERVICE COMMISSION

CIVIL SERVICE COMMON EXAMINATION (CSCE) 2009

EXAMINATION CATEGORY: **TECHNICAL**

PAPER III: SUBJECT SPECILIZATION PAPER FOR **GEOLOGY**

Date : 8th November 2009

Total Marks :100

Examination time :2.5 hrs

Reading time :15 minutes

This paper is divided into two sections A and B has 10 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. An erosion removes the tops of mountains, the mountains will buoy upward. This is an example of:
    a) orographic uplift
    b) isostatic adjustment
    c) normal faulting
    d) geosynclinal development
    e) gravity sliding

2. Stalactites and stalagmites consist of deposits of
    a) calcium Carbonate
    b) magnesium Carbonate
    c) sodium Bicarbonate
    d) silica

3. Coal is formed from
    a) igneous rocks
    b) metamorphic rocks
    c) organic matter
    d) soil lava

4. Which of the following is a main component of common glass?
    a) sand
    b) water
    c) powdered Mica
    d) marble

5. Which characteristic provides best evidence about the environment in which a rock was formed?
    a) the size of rock
    b) the thickness of the rock
    c) the texture of the rock
    d) the color of the rock

6. Which is intrusive igneous rock?
    a) limestone
    b) granite
    c) slate
    d) basalt

7. Certain minerals usually break along flat surfaces, while other minerals break unevenly. This characteristic is due to the
    a) luster of the mineral
    b) age of the mineral
    c) force with which the mineral is broken
    d) internal arrangement of the mineral's atom

8. According to the principle of uniformatarianism,
    a) geologic processes we observe today have operated in the past
    b) geologic process in the past operated at the same rate as they do today
    c) all of the planets formed from a uniform solar nebula
    d) early Earth was covered by a uniform magma ocean

9. The process by which an originally homogeneous Earth developed a dense core and a light crust is called:
    a) metamorphism
    b) differentiation
    c) accretion
    d) compression

10. Limestone is a sedimentary which may form as a result of
    a) melting
    b) recrystallization
    c) biologic process
    d) metamorphism

11. Which of the following describes the build up and release of stress during an earthquake?
    a) the Modified Mercalli Scale
    b) the elastic rebound theory
    c) the principle of superposition
    d) the travel time difference

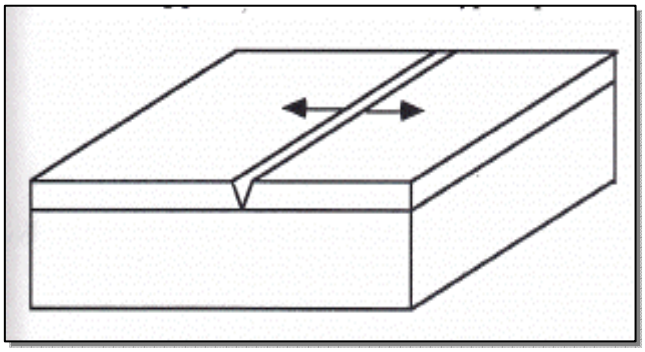
12. _____is called the "father" of geology.
    a) John Butler
    b) Art Smith
    c) James Hutton
    d) Alfred Wegner

13. New seafloor is created at a _____?
    a) deep-sea trench
    b) mid-ocean ridge
    c) subduction zone
    d) transform fault

14. The name of the layer of the Earth that separates the crust from the core is the ___?
    a) Magma
    b) Lithosphere
    c) Asthenosphere
    d) Mantle

15. What powers the Earth's internal heat engine?
    a) radioactivity
    b) solar energy
    c) volcanoes
    d) ocean tides

16. A _____ plate boundary is illustrated in the figure shown below.
    a) transform fault
    b) divergent
    c) convergent – subduction
    d) convergent - continent/continent collision

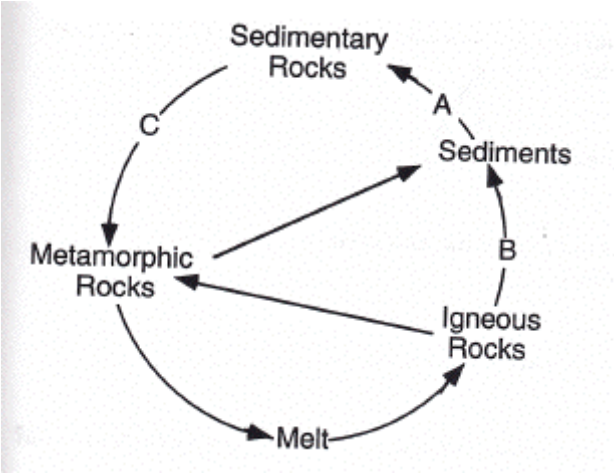


17. The changes observed in the fossil record from the Precambrian Era to the Cenzoic Era best provides evidence of
    a) planetary motion
    b) evolution
    c) radioactive decay
    d) sublimation

18. What is the name of the large supercontinent that existed 200 million years ago when all of the continents were together?
    a) San Andreas
    b) Andian
    c) Indian
    d) Pangaea

19. Why is our vulnerability to natural disasters growing?
    a) because the frequency of volcanic eruptions is increasing
    b) because the human population is increasing
    c) because the number of earthquakes each year is increasing
    d) because the number of floods each year is increasing

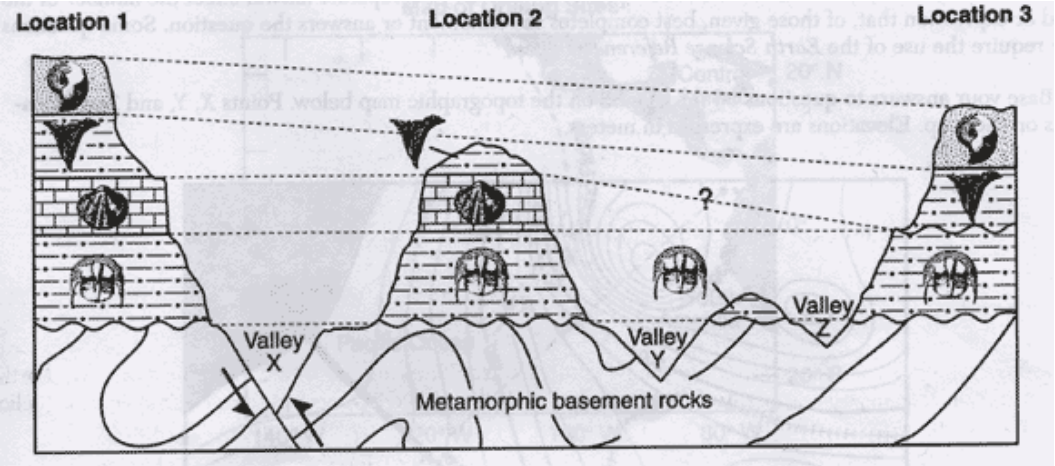
20. Referring to the diagram below, path A is _____
    a) cooling and crystallization
    b) burial and lithification
    c) weathering and deposition
    d) cooling and uplift



21. Referring to the diagram above (in question 20), path B is _____
    a) uplift, weathering and erosion, deposition
    b) deposition, heat and pressure, weathering
    c) melting, crystallization, heat and pressure
    d) deposition, lithification and crystallization

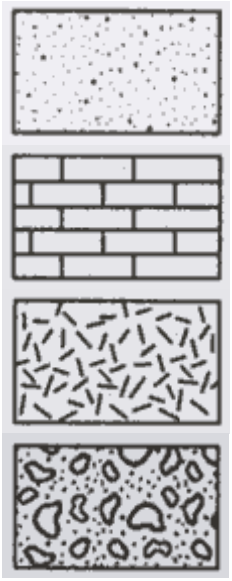
22. Referring to the diagram above (in question 20), what factor(s) are responsible for path C?
    a) melting
    b) crystallization
    c) heat and pressure
    d) burial and lithification

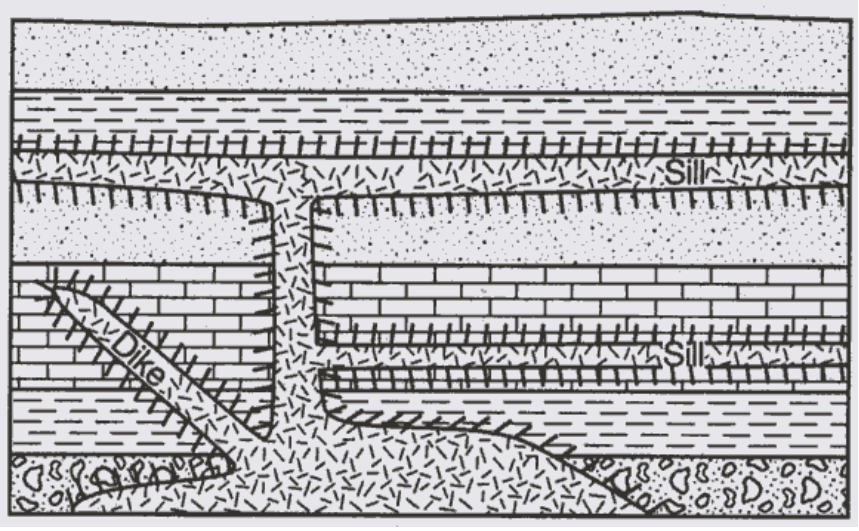
23. In diagram below, in which type of environment were the sediments that formed these sedimentary rock layers most likely deposited?
    a) glacial
    b) mountainous
    c) marine
    d) terrestrial plateau



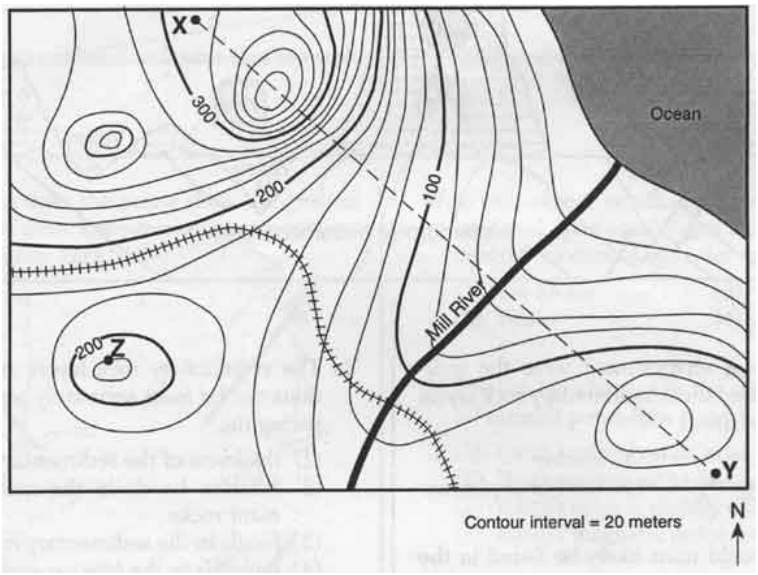
24. Base your answer to this question on the geologic cross section below. Overturning has not occurred. The dike and sills shown in the cross section are igneous intrusions. Which rock type is the oldest?

a)
b)
c)
d)

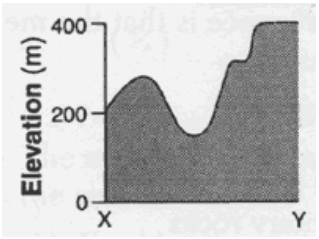




25. Which profile best represents the topography along the dashed line from point *X* to point *Y*?



a.



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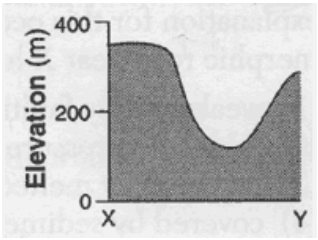

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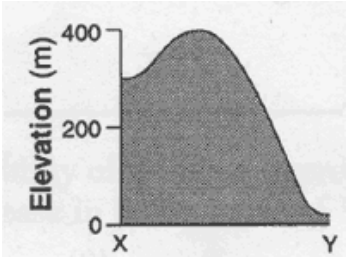

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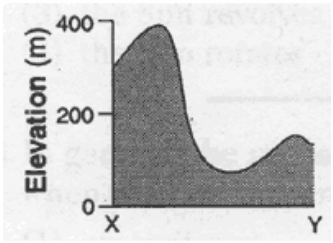
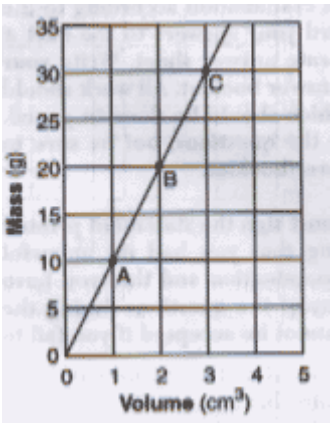


26. The graph below shows the relationship between mass and volume for three samples, A, B, and C, of a given material. What is the density of this material?

a) 1.0 g/cm³
b) 5.0 g/cm³
c) 10.0g/cm³
d) 20.0g/cm³



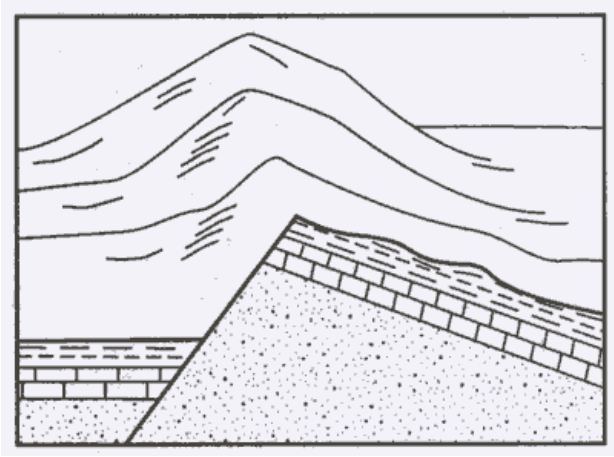
27. Which sedimentary rock is like to be changed to slate during regional metamorphism?
    a) Breccias
    b) Conglomerate
    c) dolostone
    d) shale

28. Which factor has the greatest influence on the weathering rate of Earth's surface bedrock?

    a) Local air pressure
    b) Angle of insolation
    c) Age of the bedrock
    d) Regional climate

29. The diagram below shows the bedrock structure beneath a series of hills. Which process was primarily responsible for forming the hills?

a) Folding
b) Faulting
c) Deposition
d) Volcanism



30. Two streams begin at the same elevation and have equal volumes. Which statement best explains why one stream could be flowing faster than the other stream?

a) The faster stream contains more dissolved minerals.
b) The faster stream has a much steeper gradient.
c) The streams are flowing in different directions.
d) The faster stream has a temperature of 10°C, and the slower stream has a temperature of 20°C.

Question 2 (20 marks);

i. Briefly describe about the general geology of the Bhutan Himalayas?

ii. State the differences between a rock and mineral? Give few examples of each.

iii. Explain different types of faults with proper illustrations?

iv. List main differences between subduction zone and continent-continent collision zone? Give at least one example of each.

SECTION B: Case Study

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

Case Study 1:

You are being assigned to lead a team to conduct detailed limestone exploration project in southern Bhutan within the Jaishidanda Formation of the Lesser Himalaya and fairly close to motorable road. As per available information from preliminary geological investigation of the study area, it has also been reported that average thickness of limestone band is around 25m along strike continuity of approximately 500m. Based on analytical results of few random samples collected, the average grade of the limestone has been reported as follow:

CaO	MgO	SiO2+AI	Fe2O3	Al2O3	L.O.I
45.48%	1.63%	14.80%	0.86%	2.24%	35.74%

Keeping in mind the above objectives, discuss in detail, what are the things you would require to do before proceeding to the field? Once in the field, outline and explain the detailed approaches that you as a geologist would undertake to fulfill the objective of the project.

Based on the analytical results and other factors that determine the feasibility of the target area for further investment, discuss in detail the following in the report you are preparing to submit.

Introduction

Aims and objective of the work

Location and geology of the area

Methodology

- Detailed topographic mapping (mention appropriate scale)
- Grade analysis (assume analytical result of detailed samples you collected agree with the grab sample result mentioned above)
- Probable reserve calculation (using specific gravity of limestone as 2.67 use cross-sectional method to calculate the reserve)
- Market factor

Conclusion and recommendations (here you can justify whether to further invest in the area or abandon completely)

OR

Case Study 2:

You are asked to carry out preliminary geotechnical stability and hazard assessment of a new township development in Phuentsholing extended area. Considering hazards such as earthquake, landslide and flash flood—which a mountains country like Bhutan is highly vulnerable from—prepare a preliminary risk assessment report in the format shown below.

Introduction

Aims and objectives

Location and geology of the area

Methodology

- ✓ Hazard and Risk Assessment
- ✓ Vulnerability Assessment
- ✓ Geotechnical field assessment

Conclusion and recommendations