**Earthquake Prediction**

**Paragraph 1**

Accurate prediction of earthquakes is not currently possible, although intensive research is proceeding in many areas.

**Paragraph 2**

**Two types of earthquake prediction are theoretically possible**. The first type is long-term forecasting, in which the probability of an earthquake along a particular segment within a certain time interval is calculated by studying seismic gaps and historical records of earthquakes that have occurred along that fault segment. By **plotting** the number of earthquakes within specific time intervals against their magnitudes, diagrams can be constructed for a local area. From this plot it is possible to determine the recurrence interval, or the average time interval between earthquakes of a specific magnitude. Predictions can then be made that an earthquake of that magnitude has a high probability of occurrence within a **specified** time interval, if the date of the last earthquake is known.

1. The word **specified** in the passage is closest in meaning to
2. probable
3. stated
4. short
5. typical

1. According to paragraph 2, all of the following information is used in the process of long-term earthquake prediction EXCEPT the
2. analysis of seismic gaps
3. record of past earthquakes in the fault area
4. date of the last recorded earthquake in the area
5. pattern of earthquake activity in other nearby fault segments

1. According to paragraph 2, long-term forecasting can be used to predict which of the following？
2. The influence of earthquake activity in one segment of the fault area on other segments
3. The frequency with which earthquakes of a certain size will occur
4. The possible date of the next earthquake
5. The magnitude of the next earthquake

**Paragraph 3**

Research leading to short-term forecasting, which involves a shorter time interval, has been **focused** on precursors observed prior to previous earthquakes. Precursors are physical or chemical phenomena that occur in a typical pattern before an earthquake. These phenomena include changes in the velocity of seismic waves, the electrical resistance of rocks, the frequency of the usually minor preliminary earthquakes (foreshocks), the deformation of the land surface, and the water level or water chemistry of wells in the area. Many of these precursors can be explained by a theory called the **dilatancy model**. Under this hypothesis, rocks in the process of strain along a fault show significant dilation or swelling before rupture. This volume increase is caused by the opening of microcracks, which are **minute【发音】** failure zones in weaker mineral grains【石头的纹理】 in the rock and along grain boundaries. Groundwater flows into the highly stressed areas during the formation of microcracks. These changes in density and water content affect the ability of the rock to transmit seismic waves and conduct electricity. Therefore, seismic-wave velocity and electrical resistance progressively change as the overall rupture along the fault **draws** near. Localized changes in land-surface elevation are also related to volume changes at depth. An area of recent uplift along the **San Andreas Fault** near Los Angeles, which has been named the Palmdale Bulge, is being monitored in great detail as a possible indicator of a future earthquake.

1. The word **focused** in the passage is closest in meaning to
2. dependent
3. funded
4. concentrated
5. published

5. Paragraph 3 mentions all of the following as examples of precursors EXCEPT

1. changes in the speed of seismic waves
2. changes in the availability of electricity
3. changes in the frequency of foreshocks

D. changes in land surfaces

6. According to the dilatancy model, what happens to rocks shortly before an earthquake？

1. They lose significant amounts of moisture.
2. They show signs of expanding.
3. They move downward at great speed.
4. They increase in temperature.

7..According to paragraph 3, the groundwater that flows into microcracks before an earthquake causes \_\_\_

1. changes in seismic waves and electrical activity
2. increases in the mineral content of rocks
3. the disappearance of grain boundaries in rocks
4. a release in the tension of highly stressed areas of rocks

8..The author discusses the **San Andreas Fault** near Los Angeles in order to

1. contrast past and future patterns of earthquake activity in the area
2. give an example of an area where underground earthquake activity is apparent from land changes above the ground
3. explain why recent earthquake predictions have increased accuracy
4. suggest that some areas of earthquake activity are easier to monitor than others

**Paragraph 4**

**Volume changes and groundwater movement** may be reflected by changes in water levels in wells and also by changes in the chemical composition of groundwater. Radon gas has been observed to increase in wells prior to earthquakes. These increases are perhaps related to the release of radon gas from rocks during the formation of microcracks. The pattern of seismic activity is also significant in the vicinity of a fault area where rupture is **imminent**. This pattern consists of an initial rise in the number of small events, followed by a decline in foreshocks just prior to the major earthquake. The decline may represent a temporary increase in rock strength before the newly formed microcracks are filled with water.

9..According to paragraph 4, which of the following occurs just before an earthquake

1. The chemical content of groundwater drops.
2. The rocks weaken as they fill with water.
3. Seismic activity decreases.
4. Radon gas ~~causes~~ microcracks to form.

10..The word **imminent** in the passage is closest in meaning to

1. frequent
2. well understood
3. known to occur
4. about to happen

**Paragraph 5**

**The precursor phenomena can be grouped into stages according to the dilatancy model.** Stage I consists of a gradual stress buildup along the fault. ■Stages II and III are correlated with dilatancy and water influx. Stage IV is the major earthquake, and stage V is the aftermath of the event. ■If every earthquake followed the sequence with uniform stage duration, earthquake prediction would be a simple matter. ■Instead of following the same patterns, each earthquake is unique in terms of specific precursor behavior patterns and length of precursor stages. ■A magnitude 6.9 North American earthquake in 1989 was preceded by a substantially smaller magnitude 5 earthquake fifteen months before the event. Another foreshock of similar size occurred two months before the event. In each case, a public advisory was issued stating that those smaller earthquakes could be foreshocks to a stronger earthquake within five days. However, the fault did not cooperate, and those predictions were not successful. Continued research and study of future earthquakes will certainly lead to **refinement** of the dilatancy model or to a replacement model with more accurate predictive capabilities.

11..How is paragraph 5 organized

1. The sequence of earthquake stages is given, and the effect of variable stage length on earthquake prediction is explained.
2. The earthquake stages are named, and the most important stage is illustrated with a specific earthquake event.
3. The sequence of earthquake stages is given, and evidence is presented that the intervals between stages are roughly equal in length.
4. The earthquake stages are first named, and each is then described in greater detail.

12..The word **refinement** in the passage is closest in meaning to

1. reconsideration
2. acceptance
3. improvement
4. extension

13..Look at the four squares that indicate where the following sentence could be added to the passage.

**But the reality of earthquake forecasting is considerably more complex.**

Where would the sentence best fit? Click on a square to add the sentence to the passage.

14..Drag your choices to the spaces where they belong. To review the passage, click on View Text. Answer Choices

1. Short-term forecasting has been used ~~more widely~~ than long-term forecasting in the prediction of earthquakes.
2. Long-term forecasting of earthquakes uses data on past seismic activity to determine the likelihood that an earthquake will occur in a certain area within a certain time period.
3. Short-term forecasting research has studied earthquake precursors such as volume increases in rocks and unusual movements in underground water that occur shortly before an earthquake takes place.
4. The dilatancy model has been used to ~~successfully~~ forecast some recent earthquakes.
5. Attempts to improve forecasting by using five stages of earthquake predictors have been unsuccessful because each earthquake has unique precursor patterns and durations.
6. ~~The magnitude 6.9 North American earthquake in 1989~~ was not successfully predicted because the many foreshocks before the event were too small to measure.