**Reasoning Rubric:**

**THE RUBRIC:** Joe

**Correct Claim:** XXX

**Sound justification:** XXX

**Sound connection:** XXX

**Convincing mechanism:** XXX

<table>
<thead>
<tr>
<th>Core</th>
<th>Description</th>
<th>Example Student Response</th>
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</thead>
<tbody>
<tr>
<td>5</td>
<td>Student explicitly connects a stated claim to their justification of the claim. It must include a scientifically correct mechanistic or causal explanation (likely from the item). And the overall argument is persuasive/convincing.</td>
<td><strong>Claim? XXX. [XXX]</strong></td>
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<td></td>
<td>D2 T2 V3 S25 The strengths of earthquakes is related to how close they are to the earth's surface, they type of rock they travel through, and the temperature when they occurred. If you look at Joe's chart, you see that the softer the rock, the greater MMI. For earthquake A, the MMI was 12. The rock type was soft. Earthquake E on the other hand, had a MMI of 5. The rock type was very hard. This can tell us that the variable of rock type can change the strength of an earthquake. / If you look at how close to the surface the earthquake is, you can see that the strength of the earthquake also changes. Look at earthquake B and C. The strengths of these earthquakes are similar, only 2 units in difference. They both have soft rock, so that wasn't what caused the change in their MMI. If you look at the depth, where the earthquake started, they are very different. Earthquake B started 115 km below the surface, while earthquake C started 222 km below the surface. So this tells us that the closer to the surface the earthquake starts, the more powerful. / The last thing you can look at on Joe's chart is the average temperature where the earthquake took place. Compare B and E, for instance. You can tell that earthquake B was more powerful. Their temperatures were also different. Earthquake B had an average temperature of 31 degrees (C). But earthquake E had an average temperature of 68 degrees (C). This comparison can also tell us that a temperature variable can also change the power of an earthquake. / These observations can be true for different reasons. In temperature, maybe the warmer climates can cause a reaction that stimulates and earthquake to be weaker. With depth,</td>
<td><strong>Justification? XXX. [XXX]</strong></td>
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<td></td>
<td><strong>Connection? XXX. [XXX]</strong></td>
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<tr>
<td></td>
<td><strong>Mechanism? XXX. [XXX]</strong></td>
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maybe the closer the earthquake will be more powerful because it has less ground to cover. And maybe the softer rocks are easier to get through, so it takes less energy out of the earthquake. It doesn't matter whether or not you're on an island when an earthquake strikes. Maybe the quake will cause other natural disasters, such as a tsunami, but there is nothing that is unique about an island that will cause the earthquake to be stronger than in the middle of a continent.

Student explicitly connects a stated claim to their justification of the claim. It must include a mechanistic or causal explanation (likely from the item).

**Claim?** How close they are to the Earth's surface and the type of rock they travel through. If an earthquake doesn't start very deep in the Earth, it will have more power left, meaning more damage. If they don't travel through hard rock, they won't have to use their power on getting to the surface, also meaning that they have more power left for surface damage. The surface temperature won't affect the tectonic plates inside the Earth, so it won't affect the earthquake.

**Justification?** How close they are to the Earth's surface, the type of rock they travel through and the average air temperature when they occurred. This is true because they need more power to go through hard rock surfaces and deep places rather than soft rock surfaces and shallow places. The air temperature contributes to this too. Plus, they were both on the chart. It doesn't matter if they occur on islands or on mainlands, there would be the same result.

**Connection?** How close they are to the Earth's surface and the type of rock they travel through and how close they are to the Earth's surface. I used the table and made connections between the table's data. It does not use the information from the table.

**Mechanism?** The strength of the earthquake relates to how close the earthquake is to the surface of the Earth and the rock type. This is because the strongest earthquake was the closest to the Earth's surface but had the softest rock. The weakest earthquake was the opposite. One claim that's wrong is that the air temperature relates to the strength. This is wrong because the air temperatures are mixed. For example, the coldest air temperature was during the middle intensity.

**Claim?** The cause of some earthquakes to have more destructive power than others is the seconds.

**Connection?** The connection only exists in that the argument is circular – the claims and justification are restatements of the same idea.
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<tbody>
<tr>
<td>1</td>
<td>Student provides a justification that simply restates the claim. <strong>D3 T3 V1 S02</strong> how close they are to the Earth's surface &amp; the type of rock they travel through. Because of the already listed facts this claim is well supported. Whether they happen on islands or not will not affect the power of the earthquake, because it does not matter. <strong>D2 T2 V5 S03</strong> How close they are to the earth's surface and the type of rock they travel through. Because all the other answers are irrelevant to the question at hand. They have nothing to do with earthquakes.</td>
<td>[There is no mechanistic explanation the relationship between ground material and the strength of an earthquake.]</td>
<td>[Points out the directional relationship between ground density and earthquake strength.]</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>0</td>
<td>Student does not provide a justification that is related to their claim. <strong>D2 T2 V3 S26</strong> How far from the earth's surface they are and the type of rock they travel through. This is true because science can prove it. Because whether they happen on islands or not won't really affect anything. <strong>D2 T2 V5 S22</strong> A Volcano is related to an earthquake. Because a volcano is extremely deadly and dangerous.</td>
<td>None</td>
<td>XXX</td>
<td>XXX</td>
<td>XXX</td>
<td>XXX</td>
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THE RUBRIC:

Correct Claim: Student states that earthquake destructiveness is dependent on crust temperature, depth, and hardness of ground. Student may focus on multiple factors, but only one is sufficient.

Sound justification: It is clear that the student is basing their claim on data from the table they were given.

Sound connection: Student makes the connection that earthquake destructiveness is inversely proportional to crust temperature, depth, and hardness of ground. Student may focus on multiple factors, but only one is sufficient.

Convincing mechanism: Student explains that greater destruction occurs when seismic waves transmit more easily (i.e., softer ground) and have less time for their energy to dissipate (i.e., begin closer to the Earth’s surface).

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<td>5</td>
<td>Student explicitly connects a stated claim to their justification of the claim. It must include a scientifically correct mechanistic or causal explanation (likely from the item). And the overall argument is persuasive/convincing.</td>
<td>Claim? If it’s cooler, closer to the surface, and the ground is soft the earthquakes will be more destructive. [Student states that earthquake destructiveness is dependent on crust temperature, depth, and hardness of ground. ]</td>
<td>Justification? [It is implicitly clear that the student has appealed to the temperature, depth, and hardness columns of the data table.] Connection? [Since the student says “cooler,” “closer to the surface,” and “the ground is soft,” they have gone beyond listing the table columns (e.g., temperature, depth, hardness) and actually juxtaposed the data to make inferences about the DIRECTION of associations between each factor and</td>
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This would make it closer and easier to move quickly. [Student grasps that the closer an earthquake occurs to the surface and the less time there is for its energy to dissipate, the greater its destructiveness. Furthermore, the student grasps that destructiveness is associated with a COMBINATION of depth and ground hardness, and not just reliant on one of the factors independent of the other. Hence the mechanism is CONVINCING]

Claim?

Justification? [It is implicitly clear that the student has appealed to the temperature, depth, and hardness columns of the data table.]

Connection? [Student has gone beyond listing the table columns (e.g., temperature, depth hardness) and actually juxtaposed the data to make inferences about the DIRECTION of associations between each factor and earthquake destructiveness.]

Mechanism? [While the student does indeed pose some mechanistic links between claim and justification, they are NOT CONVINCING for the following reasons:]

1) the student says the earthquake will be bigger when the ground is harder, but the data suggests precisely the opposite.
2) the student does not explicate how a cooler crust temperature facilitates faster earthquake wave propagation.

3) the student considers earthquake depth independent of the material earthquake waves are propagating through (e.g., what about deep earthquakes propagating through soft ground vs. shallow earthquakes propagating through hard ground?)

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Student explicitly connects a stated claim to their justification of the claim.

**Claim?** [Student states that earthquake destructiveness is dependent on crust temperature, depth, and hardness of ground.]

**Justification?** [It is explicitly clear that the student has appealed to the temperature, depth, and hardness columns of the data table.]

**Connection?** [Student has gone beyond listing the table columns (e.g., temperature, depth, hardness) and actually juxtaposed the data to make inferences about the direction of associations between each factor and earthquake destructiveness.]

**Mechanism?** [No mechanism is provided to explain the inverse relationship between destructiveness vs. temperature, depth, and hardness.]

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Student implies a connection between a stated claim and justification of the claim. Or the justification restates the claim.

**Claim?** The ground hardness affects the earthquake size. [Student states that earthquake destructiveness is dependent on hardness (e.g., what about deep earthquakes propagating through soft ground vs. shallow earthquakes propagating through hard ground?)]

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3) The student considers earthquake depth independent of the material earthquake waves are propagating through (e.g., what about deep earthquakes propagating through soft ground vs. shallow earthquakes propagating through hard ground?)

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Student explicitly connects a stated claim to their justification of the claim.

**Claim?** The ground hardness affects the earthquake size.

**Justification?** It is explicitly clear that the student has appealed to the temperature, depth, and hardness columns of the data table.

**Connection?** Student has gone beyond listing the table columns (e.g., temperature, depth, hardness) and actually juxtaposed the data to make inferences about the direction of associations between each factor and earthquake destructiveness.

**Mechanism?** No mechanism is provided to explain the inverse relationship between destructiveness vs. temperature, depth, and hardness.
ground. This is an example of where a focus on only one factor is sufficient to get credit for advancing a claim.

Justification? A reason found out was from the chart. [It is clear that the student has appealed to the hardness column of the data table.]

Connection? [No. The final sentence just restates the claim, so an explicit connection between claim and justification is not provided.]

Mechanistic link? [No. A mechanism entails first having a connection. As no explicit connection was made, nor does the student provide an explicit mechanism.]

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1 Student provides a claim that answers the question.

Claim? Some earthquakes can be more destructive than others because of the way how much the crust actually moves. [Student states that earthquake destructiveness is dependent on the way the crust moves.]

Justification? [No. It is not clear that the student appealed to the data table as they tend to focus on the way the crust moves, which is not one of the variables in the data table. One place where they do refer to a variable in the data table – depth – they seem to indicate that deeper earthquakes are more destructive, which is opposite what the data table suggests.]

Connection? [No. As no explicit appeal was made to the data, the student does not have justification and hence cannot make a connection between claim and justification.
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<td>Student does not provide a claim that answers the question.</td>
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Mechanistic link? [No. A mechanism entails first having a connection. As no explicit connection was made, nor does the student provide an explicit mechanism. Note that the student does seem to think mechanistically in terms of crust movement, but this mechanism does not link their claim to the evidence presented in the data table.]

At most, student reiterates notion that earthquake magnitudes can vary (e.g., “Most are very soft and some are very rough, some shake houses and some people notice it is happening”). The remainder of the student response merely presents some general comments about earthquakes. At no point is a claim advanced regarding why earthquake destructiveness can vary. |