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| --- | --- | --- | --- |
| **12 Core STEM Activities** | **Related Student Performance Expectations (SPEs)** | **Related NGSS Cross-cutting Concepts (CCCs)** | **Related NGSS Science & Engineering Practices (SEPs)**  |
|  |  | Patterns | Cause & Effect | Scale, Proportion & Quantity | Systems & System Models | Energy & Matter: Flows, Cycles, and Conservation | Structure & Function | Stability & Change | Asking Questions & Defining Problems | Planning & Carrying Out Investigations | Analyzing & Interpreting Data | Developing & Using Models | Constructing Explanations and Designing Solutions | Engaging in Argument from Evidence | Using Mathematics and Computational Thinking | Obtaining, Evaluating, and Communicating Information |
| **1. Guitar Geometry**  | HS-PS-3-3: Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.   | ✓ |  | ✓ | ✓ |  | ✓ |  | ✓ |  | ✓ | ✓ |  |  | ✓ | ✓ |
| **2. CAD/CAM** | HS-PS-3-3: Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.   | ✓ |  | ✓ | ✓ |  | ✓ | ✓ | ✓ | ✓ |  | ✓ |  |  | ✓ | ✓ |
| **3. Electronics** | HS-PS2-5: Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.   | ✓ | ✓ | ✓ |  | ✓ |  |  | ✓ | ✓ | ✓ |  | ✓ |  | ✓ |  |
| **4. Material Properties of Wood**  | HS-PS2-6: Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.   | ✓ |  | ✓ |  |  | ✓ | ✓ | ✓ | ✓ | ✓ |  | ✓ | ✓ | ✓ |  |
| **5. Guitar Anatomy and Cost Estimate** | HS-PS-3-3: Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.   | ✓ | ✓ | ✓ |  |  | ✓ |  | ✓ | ✓ | ✓ |  | ✓ | ✓ | ✓ | ✓ |
| **6. Tolerances in Engineering Drawings** | HS-PS2-6: Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.   | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **7. Scale Length, Frequency, & Tension** | HS-PS-3-2: Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects). | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |  |
| **8. Fret Spacing Calculation** |  | ✓ | ✓ | ✓ | ✓ |  | ✓ |  | ✓ |  | ✓ |  | ✓ | ✓ | ✓ |  |
| **9. Threaded Fasteners** | HS-PS2-6: Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.   | ✓ |  | ✓ | ✓ | ✓ | ✓ |  | ✓ |  | ✓ | ✓ | ✓ |  | ✓ |  |
| **10. Set Up** | HS-PS-3-2: Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects). | ✓ | ✓ | ✓ |  | ✓ | ✓ |  | ✓ | ✓ | ✓ |  | ✓ |  |  | ✓ |
| **11. Guitar Necks: Compression and Tension** | HS-PS2-6: Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.   | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |  |
| **12. Intonation** | HS-PS4-1: Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.   | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |  | ✓ |  | ✓ | ✓ | ✓ |  |

For more information, please visit:

<http://www.guitarbuilding.org>

References

NGSS Lead States. 2013. *Next Generation Science Standards: For States, By State*s. Washington, DC: The National Academies Press.