Class XI - SCIENCE STREAM

Holiday Homework 2025 PHYSICS, CHEMISTRY, BIOLOGY, BIOTECHNOLOGY & COMPUTER SCIENCE Exploring Quantum Science and Technology: Unlocking the Future of Innovation

What is Quantum?

The word quantum refers to the smallest possible unit of energy or matter in physics. Quantum science studies how particles like electrons and photons behave at the tiniest scales—where the rules are very different from everyday life. Phenomena like superposition (being in multiple states at once) and entanglement (particles being linked even at great distances) are central to quantum science. It helps explain how atoms interact, how light travels, and how modern technologies like quantum computers work.

Quantum science is unlocking doors to unimaginable possibilities—from unbreakable encryption and ultra-fast computing to advanced sensors and new forms of communication. Through this project, students will explore how the concept of quantum applies not only in physics but also in chemistry, biology, biotechnology, and computer science.

A. Group Project (To be done in groups of 5 students): Quantum Science and Technology

Task 1: Survey & Awareness

- Create a Google Form survey to gauge public awareness and understanding of Quantum Science and Technology.

- Include at least 10 well-crafted questions.

Examples of survey questions:

- Have you ever heard about Quantum Computers?
- Do you know how Quantum Physics is different from classical physics?
- Can you name any invention using Quantum Technology?
- Can quantum principles be used to make medicines more effective?
- Do you think quantum technology can make secure communications in hospitals?

Task 2: Research & Analysis

- Analyze the collected data and identify major knowledge gaps or misconceptions.

- Research any 3 to 5 quantum technologies or applications being used globally. Example Topics:
- How quantum computers are used for secure banking?
- Quantum sensors in medical devices.
- Quantum communication in secure messaging.
- Quantum Chemistry in drug design.

Task 3: Idea Generation

- Based on the problems or knowledge gaps identified in Task 2, brainstorm possible solutions using quantum principles.

Examples:

- A quantum-based app that can secure online chats.

- A medical sensor that uses quantum light to detect diseases.
- A quantum-based diagnostic tool for rapid disease detection.

Task 4: Prototype Design

- Choose one idea and create a design/layout (on A-4 paper or digitally) for your proposed quantumbased product or service.

Examples:

- Draw a model of a Quantum Secure Messaging App.
- Create a design of a Quantum Health Detector.
- Design a Quantum-Powered Medicine Delivery System.

Task 5: Business Plan (B-plan)

- Create a business model around your idea: target audience, market need, potential pricing, and delivery model.

Examples:

- Who will use your Quantum Secure Messaging App?
- How much will it cost?
- How will you make it available?

B. VISUAL WONDERS OF SCIENCE

- Each student must individually prepare a creative and informative display on any of the topic given below;

- Topics may include Nobel Prizes, Inventions, Latest Discoveries, Scientific Innovations, Environmental Solutions, Health Sciences, etc.

- Prepare a visually engaging A3 sheet or Chart on a topic relevant to your subject.
- The display should be attractive and catch the attention of viewers and spark interest in the topic.

- Use less text and more visuals—draw or paste colourful printed images to convey your message effectively.

Wishing you a creative and enjoyable learning experience!

FOR MATHS STUDENTS ONLY

The United Nations General Assembly declared 2025 as the International Year of Quantum Science and Technology to promote global collaboration in Quantum Science and Technology .The word "quantum" originates from the idea that physical properties, such as energy, are not continuous but rather exist in specific—or quantized amounts. A quantum is the smallest possible unit of a physical property.For example, a photon is a quantum of light. The principles of quantum mechanics are used in developing new technologies with potential applications in computing, communication, and sensing using mathematical tools Wave-Particle Duality & Probability

Concept: In quantum physics, particles (like electrons) behave like both particles and waves. **Math Connection:** This is described using *probability* and *wave functions*.

A wave function (Ψ) is a mathematical function that contains information about a particle's state.

The square of the wave function, $|\Psi(x)|^2$, gives the probability of finding the particle at position x.

Probability from Wave FunctionPhysics Idea: We can't say exactly *where* a particle is—only the *probability* of where it might be.

Math Example: Let's say a wave function is: $y = \sqrt{2} \sin(\pi x)$, for $0 \le x \le 1$

To find the probability of a particle being between x=0.3and x=0.7, we calculate:

 $P = \int_{0.3}^{0.7} |\psi|^2 dx = \int_{0.3}^{0.7} 2\sin^2(\pi x) dx$

Directions

A group of 6 students will work on a project in which you are to draw all six Trigonometric functions (one each by a student) on a full chart paper(e.g y=sinx, taking angle x along x axis and getting sinx along y axis) and then study the following properties of trigonometric functions and list the properties as per given instructions

Graphs of trigonometric functions reveal a number of important characteristics and

observations. Here's a breakdown of the key observations you can make from these graphs: **1. Periodicity**

- 1. Periodicity
- 2. Amplitude
- 3. Domain and Range
- 4. Symmetry (Even/Odd Nature)
- 5. Intercepts

6.vertical Asymptotes of Tangent and Cotangent, Secant and Cosecant

sketch a comparative table to visualize these observations

Feature	sine	cosine	tangent	cotangent	secant	cosecant
Graph shape						
Period						
Amplitude						
Domain						
Range						
x-intercept						
y- intercept						
Vertical						
asymptote						
symmetry						