

Research Topics for Senior High School Students

Renewable Energy Sources

- **Solar Power**
 - **Types:** Photovoltaic cells, thin-film, concentrated solar.
 - **Efficiency:** How different panels perform.
 - **Cost:** Price vs. savings over time.
 - **Environmental Impact:** Space and resource use.
- **Wind Energy**
 - **Turbines:** Horizontal vs. vertical designs.
 - **Location:** Factors affecting where to place wind farms.
 - **Output:** How much energy can be generated.
 - **Wildlife:** Effects on animals.
- **Hydro Energy**
 - **Systems:** Run-of-river, reservoir, pumped storage.
 - **Environmental Effects:** Impact on fish and rivers.
 - **Comparison:** How it stacks up against other renewables.
 - **Local Benefits:** Effects on nearby communities.
- **Future Innovations**
 - **New Tech:** Tidal, geothermal, wave energy.
 - **Combining Sources:** Using multiple renewables together.
 - **Storage:** Advances in battery technology.
 - **Smart Grids:** Integrating renewables into energy grids.

Artificial Intelligence

- **Machine Learning**
 - **Types:** Supervised and unsupervised learning.
 - **Algorithms:** Basics of neural networks and decision trees.
 - **Data:** Importance of quality data for AI.
 - **Uses:** Examples in finance and healthcare.
- **AI in Healthcare**
 - **Diagnostics:** AI for medical imaging.
 - **Personalized Medicine:** Custom treatments based on genetics.
 - **Robotic Surgery:** Precision in operations.
 - **Predictive Analytics:** Forecasting disease trends.
- **Ethical Issues**
 - **Bias:** Problems with AI making biased decisions.
 - **Privacy:** Protecting personal data used by AI.
 - **Autonomy:** AI making decisions on its own.
 - **Regulation:** Rules for developing and using AI.

- **Future Trends**
 - **General AI:** Creating AI that can do any task a human can.
 - **AI and Robotics:** Combining AI with robots for new capabilities.
 - **Daily Life:** AI in home devices and personal assistants.
 - **Ethics and Governance:** Rules for responsible AI use.

Climate Change

- **Global Warming**
 - **Greenhouse Gases:** Role of CO2 and methane.
 - **Temperature Trends:** Historical and recent changes.
 - **Climate Models:** Predictions for the future.
 - **Mitigation:** Ways to reduce emissions.
- **Impact on Ecosystems**
 - **Species:** How animals and plants are moving or changing.
 - **Coral Reefs:** Effects of warmer oceans on reefs.
 - **Forests:** Impact on trees and deforestation.
 - **Ocean Acidification:** Effects on marine life.
- **Mitigation Strategies**
 - **Renewable Energy:** Using wind and solar to cut emissions.
 - **Efficiency:** Making buildings and transport more efficient.
 - **Carbon Sequestration:** Capturing CO2 from the air.
 - **Policies:** International and national climate policies.
- **Local Effects**
 - **Weather Changes:** Regional climate impacts.
 - **Agriculture:** How farming is affected.
 - **Extreme Weather:** More frequent storms and heatwaves.
 - **Community Adaptation:** How local areas are adjusting.

Genetic Engineering

- **CRISPR Technology**
 - **How It Works:** Basics of gene editing with CRISPR.
 - **Uses:** Applications in medicine and agriculture.
 - **Ethical Concerns:** Issues with editing human genes.
 - **Regulation:** Rules for gene editing.
- **Ethical Considerations**
 - **Human Enhancement:** Modifying humans for better traits.
 - **Biodiversity:** Effects on ecosystems.
 - **Equity:** Access and fairness in genetic tech.
 - **Consent:** Consent for genetic changes.
- **GMOs**
 - **Advantages:** Benefits like higher yields and pest resistance.
 - **Risks:** Potential health and environmental risks.

- **Labeling:** Debate over labeling GMO foods.
 - **Public View:** How GMOs are perceived.
- **Medical Applications**
 - **Gene Therapy:** Treating diseases by editing genes.
 - **Pharmaceuticals:** Creating drugs through genetic methods.
 - **Personalized Medicine:** Customizing treatments.
 - **Ethical Issues:** Concerns with genetic medicine.

Cybersecurity

- **Threats**
 - **Types of Attacks:** Phishing, malware, ransomware.
 - **Methods:** How attacks are carried out.
 - **Impact:** Effects on individuals and organizations.
 - **Notable Breaches:** Examples of major security failures.
- **Protective Measures**
 - **Best Practices:** Strong passwords, two-factor authentication.
 - **Tools:** Use of firewalls and antivirus software.
 - **Encryption:** Protecting data with encryption.
 - **Response:** What to do after a breach.
- **Privacy Concerns**
 - **Data Collection:** How data is gathered and used.
 - **Laws:** Regulations like GDPR for protecting data.
 - **User Awareness:** Educating people about online privacy.
 - **Corporate Responsibility:** How companies handle user data.
- **Future Challenges**
 - **New Threats:** Emerging types of cyberattacks.
 - **AI in Security:** Using AI to detect threats.
 - **IoT Security:** Securing connected devices.
 - **Regulation:** Evolving rules for cybersecurity.

Robotics

- **Automation**
 - **Industrial Robots:** Use in factories and production lines.
 - **Home Robots:** Examples like vacuum cleaners and lawn mowers.
 - **Economic Impact:** Effect on jobs and productivity.
 - **Future Trends:** Upcoming innovations in automation.
- **Robotic Design**
 - **Components:** Sensors, actuators, and controllers.
 - **Building:** Steps to design and assemble a robot.
 - **Programming:** Basics of coding robots.
 - **Testing:** Refining robot designs.
- **Ethical Issues**

- **Employment:** Impact on jobs and workforce.
 - **Decision Making:** Ethical concerns of robots making choices.
 - **Safety:** Ensuring robots are safe to use.
 - **Privacy:** Issues with surveillance by robots.
- **Future Developments**
 - **Advanced Robots:** Innovations in humanoid and service robots.
 - **AI Integration:** Combining AI with robots.
 - **Swarm Robotics:** Multiple robots working together.
 - **Bio-Robotics:** Mixing biology with robotics.

Mental Health

- **Social Media Influence**
 - **Effects:** Impact on mental well-being.
 - **Addiction:** Risks of becoming addicted to social media.
 - **Self-Esteem:** How social media affects body image.
 - **Support:** Online resources and communities.
- **Stress Management**
 - **Techniques:** Methods like meditation and exercise.
 - **Health Impact:** How stress affects health.
 - **School Stress:** Stress from academic pressures.
 - **Counseling:** Role of school counselors.
- **Support Systems**
 - **Counseling Services:** Availability and effectiveness.
 - **Peer Support:** Importance of friends and support networks.
 - **Family Role:** Family support in managing mental health.
 - **Resources:** Access to mental health tools and services.
- **Awareness and Education**
 - **Programs:** School initiatives for mental health.
 - **Curriculum:** Teaching mental health in schools.
 - **Campaigns:** Public efforts to reduce stigma.
 - **Workshops:** Benefits of mental health education sessions.

Space Exploration

- **Recent Missions**
 - **Mars:** Updates from recent missions.
 - **Moon:** Current and planned lunar missions.
 - **Space Telescopes:** Discoveries from telescopes like Hubble.
 - **Private Space Travel:** Advances by SpaceX and Blue Origin.
- **Technological Advances**
 - **Spacecraft:** New designs and technologies.
 - **Robotic Exploration:** Robots exploring space.
 - **Satellites:** New developments in satellite technology.

- **Instruments:** Tools for studying space.
- **Human Exploration**
 - **Space Stations:** Research on the ISS.
 - **Mars and Moon Bases:** Plans for human habitats.
 - **Health Risks:** Effects of space travel on health.
 - **Astronaut Training:** Preparation for space missions.
- **Commercial Space Travel**
 - **Companies:** Overview of space tourism companies.
 - **Costs:** Economics of space travel.
 - **Regulations:** Rules for commercial space flights.
 - **Public Interest:** Growing interest in space tourism.

Waste Management

- **Recycling Methods**
 - **Materials:** Recycling paper, plastic, glass, metal.
 - **Challenges:** Issues with contamination and processes.
 - **Programs:** Effectiveness of local recycling efforts.
 - **Innovation:** New recycling technologies.
- **Waste Reduction**
 - **Strategies:** Reducing waste through reuse and composting.
 - **Impact:** Benefits of reducing waste.
 - **Public Initiatives:** Community and government efforts.
 - **Consumer Choices:** How buying habits affect waste.
- **Innovative Solutions**
 - **Waste-to-Energy:** Turning waste into energy.
 - **Biodegradable Materials:** Developing materials that decompose.
 - **Circular Economy:** Designing for reuse and recycling.
 - **Smart Waste Management:** Using tech for better waste handling.
- **Impact on Environment**
 - **Landfills:** Effects on soil and water.
 - **Pollution:** Waste's role in pollution.
 - **Wildlife:** Impact on animals.
 - **Climate Change:** How waste affects the climate.

Health and Nutrition

- **Diet and Disease**
 - **Nutritional Deficiencies:** Effects of poor diet on health.
 - **Chronic Diseases:** Links between diet and long-term health issues.
 - **Guidelines:** Recommendations for a healthy diet.
 - **Case Studies:** Success stories of dietary changes.
- **Exercise Impact**
 - **Physical Health:** Benefits of regular exercise.

- **Mental Health:** Effects on mood and stress.
- **Fitness Plans:** Creating effective exercise routines.
- **Sedentary Lifestyle:** Risks of inactivity.
- **Nutritional Myths**
 - **Misconceptions:** Common myths about diets and supplements.
 - **Evidence-Based Advice:** Using research to guide nutrition.
 - **Media Influence:** Role of media in dietary beliefs.
 - **Public Perception:** How myths impact health choices.
- **Public Health Initiatives**
 - **Programs:** School and community health programs.
 - **Campaigns:** Efforts to combat obesity and chronic diseases.
 - **Policy:** Government nutrition and health regulations.
 - **Community Engagement:** Involving people in health activities.