WILLOWS UNIFIED SCHOOL DISTRICT
Office of the Superintendent

DATE: **May 2nd, 2024**

AGENDA TOPIC: **New Course(s) Approval**

PRESENTER: **Scott J. Booth, Director of Curriculum, Instruction, and Assessment**

BACKGROUND INFORMATION:

In an effort to increase academic elective offerings, Willows High School has followed the process for this pending approval of this new courses, which has been vetted through the Curriculum, Instruction, and Assessment Advisory (CIA). This pending courses may or may not be viable for the 2024/25 school year, depending upon this approval by the Board, availability of sections in the Master Schedule, and student interest.

Pending course:

- Honors Physics

RECOMMENDATION:

Approval is recommended.

Honors Physics

Course Overview

Physics Honors is designed to allow a student to discover how the Universe works using Energy as the overarching theme. After an introductory unit on math and methods, students will complete units on Newton's Laws, Energy, Electricity and Magnetism, Waves, and Nuclear Energy. Labs and activities will be inquiry-based and phenomena will be used to engage student curiosity. In addition to written lab reports, students will write about their learning after each activity in a journal format.

Introduction to Physical Phenomena

In this first unit, students will review metrics, significant figures, dimensional analysis, scientific notation and scientific method. They will learn to use graphing utilities and calipers. Students will design labs and use vectors.

Student teams are assigned a location on campus to find the distance from that location to the physics classroom. They use graph paper to make a scale map using the tiles on the floor and the square segments of concrete in the school quad. Students will then use trig. functions or the Pythagorean theorem to calculate the displacement on a trip from the classroom to their assigned location.

Newton's Laws and Gravity

Students learn to graphically model velocity and acceleration. Students use their graphs to derive the equations of motion and then use the equations to solve for unknown quantities.

Students are teamed in groups of three. Using large portable white boards, the teams work on problems to locate all of the given information, identify unknowns and draw distance vs. time, velocity vs. time and acceleration vs. time graphs. Using the graphs, students write equations to solve for the unknowns. Student groups then share their solutions to the rest of the class.

Energy

Students begin with definitions and units of energy, momentum, work, and power. They then transition to conservation equations. They investigate numerous devices that convert energy from one form to another, ie., thermoelectric devices, generators, motors, solar cells, and turbines. They conclude by creating energy flow diagrams.

Students are asked to ascend a flight of stairs on campus as fast as they feel comfortable. They are timed, weighed, and the height of the stairs is measured. The students return to class and calculate the work done, the power output, and the energy expended in climbing the stairs. Students convert their wattage to horsepower and compare themselves to household appliances. The students also convert their energy output from Joules to calories and compute the number of trips up the stairs that would be required to burn the calories in their favorite snack.

Electricity and Magnetism

This unit begins with with the fundamentals of electrostatics, Coulomb's Law, and electric fields. Next the topics of voltage, current, resistance, and circuits using Ohms Law as a theme. Finally, students will be introduced to magnetism, electromagnetic induction, and Faraday's Law.

Students will be given enameled magnet wire, batteries, magnets, and an array of office supplies. The students will choose to build a motor, generator, speaker, or microphone. They must build a working model then explain how the devise works and use the "right hand rule" to explain the electrical and magnetic interaction. Students must also diagram all of the energy conversions that are taking place during the utilization of their device.

Waves

The waves unit begins with the characteristics of a wave, then the behavior of a wave (reflection, refraction and interference). Next the unit becomes more specific as students study sound, light, and earthquake waves. Students will look for relationships of wavelength and frequency in many different systems. Students will be introduced to quantum theory and wave particle duality.

Students working in groups of 8, must demonstrate the wavelength, frequency, and amplitude of a wave while stepping to the right and to the left to the beat of a metronome. The team aligns themselves along the tiles in our outdoor quad. They demonstrate each characteristic as the teacher circulates and checks off their progress. The teams must then double and halve the amplitude and frequency for another check mark.

Nuclear Energy

Students will explore the topics of radioactive particles and decay, half-life, fission, fusion, and nuclear power generation. This unit will include activities that teach students about background radiation, the biological effects of radiation and how shielding can stop radioactive particles. Students will hear from the Navy about how nuclear power is generated and used across our nation.

Students will learn the nuclear reactions associated with alpha and beta decay. They will complete the reaction series for U-235 as it trans-mutates to lead. In addition, they will compute the time that is required for 2 half lives of each transition to occur.