New York State High School Regents Exam Prep

Regents Physics

Regents Physics Exam Prep: 101 Facts You Should Know

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Mechanics

1. Weight (force of gravity) decreases as you move away from the earth by distance squared.
2. Mass and inertia are the same thing.
3. Constant velocity and zero velocity means the net force is zero and acceleration is zero.
4. Weight (in newtons) is mass x acceleration (w = mg). **Mass is not weight!**
5. Velocity, displacement [s], momentum, force and acceleration are vectors.
6. Speed, distance [d], time, and energy (joules) are scalar quantities.
7. The slope of the velocity-time graph is acceleration.
8. At zero (0) degrees two vectors have a resultant equal to their sum. At 180 degrees two vectors have a resultant equal to their difference. From the difference to the sum is the total range of possible resultants.
9. Centripetal force and centripetal acceleration vectors are toward the center of the circle- while the velocity vector is tangent to the circle.
10. An unbalanced force (object not in equilibrium) must produce acceleration.
11. The slope of the distance-tine graph is velocity.
12. The equilibrant force is equal in magnitude but opposite in direction to the resultant vector.
13. Momentum is conserved in all collision systems.
14. Magnitude is a term use to state how large a vector quantity is.

Energy

15. Mechanical energy is the sum of the potential and kinetic energy.
16. Units: a = [m/sec^2], F = [kg•m/sec^2] (newton), work = pe= ke = [kg•m^2/sec^2] (joule)
17. An ev is an energy unit equal to 1.6 x 10^{-19} joules
18. Gravitational potential energy increases as height increases.
19. Kinetic energy changes only if velocity changes.
20. Mechanical energy (pe + ke) does not change for a free falling mass or a swinging pendulum. *(when ignoring air friction)*
21. The units for power are [joules/sec] or the rate of change of energy.

Electricity

22. A coulomb is charge, an amp is current [coulomb/sec] and a volt is potential difference [joule/coulomb].
23. Short fat cold wires make the best conductors.
24. Electrons and protons have equal amounts of charge (1.6×10^{-19} coulombs each).
25. Adding a resistor in parallel decreases the total resistance of a circuit.
26. Adding a resistor in series increases the total resistance of a circuit.
27. All resistors in series have equal current (I).
28. All resistors in parallel have equal voltage (V).
29. If two charged spheres touch each other add the charges and divide by two to find the final charge on each sphere.
30. Insulators contain no free electrons.
31. Ionized gases conduct electric current using positive ions, negative ions and electrons.
32. Electric fields all point in the direction of the force on a positive test charge.
33. Electric fields between two parallel plates are uniform in strength except at the edges.
34. Millikan determined the charge on a single electron using his famous oil-drop experiment.
35. All charge changes result from the movement of electrons not protons (an object becomes positive by losing electrons)

Magnetism

36. The direction of a magnetic field is defined by the direction a compass needle points.
37. Magnetic fields point from the north to the south outside the magnet and south to north inside the magnet.
38. Magnetic flux is measured in webers.
39. Left hands are for negative charges and right hands are for positive charges.
40. The first hand rule deals with the B-field around a current bearing wire, the third hand rule looks at the force on charges moving in a B-field, and the second hand rule is redundant.
41. Solenoids are stronger with more current or more wire turns or adding a soft iron core.

Wave Phenomena

42. Sound waves are longitudinal and mechanical.
43. Light slows down, bends toward the normal and has a shorter wavelength when it enters a higher (n) value medium.

44. All angles in wave theory problems are measured to the normal.
45. Blue light has more energy. A shorter wavelength and a higher frequency than red light (remember- ROYGBIV).
46. The electromagnetic spectrum (radio, infrared, visible. Ultraviolet x-ray and gamma) are listed lowest energy to highest.
47. A prism produces a rainbow from white light by dispersion (red bends the least because it slows the least).
48. Light wave are transverse (they can be polarized).
49. The speed of all types of electromagnetic waves is 3.0×10^8 m/sec in a vacuum.
50. The amplitude of a sound wave determines its energy.
51. Constructive interference occurs when two waves are zero (0) degrees out of phase or a whole number of wavelengths (360 degrees.) out of phase.
52. At the critical angle a wave will be refracted to 90 degrees.
53. According to the Doppler effect a wave source moving toward you will generate waves with a shorter wavelength and higher frequency.
54. Double slit diffraction works because of diffraction and interference.
55. Single slit diffraction produces a much wider central maximum than double slit.
56. Diffuse reflection occurs from dull surfaces while regular reflection occurs from mirror type surfaces.
57. As the frequency of a wave increases its energy increases and its wavelength decreases.
58. Transverse wave particles vibrate back and forth perpendicular to the wave direction.
59. Wave behavior is proven by diffraction, interference and the polarization of light.
60. Shorter waves with higher frequencies have shorter periods.
61. Radiowaves are electromagnetic and travel at the speed of light (c).
62. Monochromatic light has one frequency.
63. Coherent light waves are all in phase.

Geometric Optics

64. Real images are always inverted.
65. Virtual images are always upright.
66. Diverging lens (concave) produce only small virtual images.
67. Light rays bend away from the normal as they gain speed and a longer wavelength by entering a slower (n) medium *{frequency remains constant}*.
68. The focal length of a converging lens (convex) is shorter with a higher (n) value lens or if blue light replaces red.

Modern Physics

69. The particle behavior of light is proven by the photoelectric effect.
70. A photon is a particle of light *{wave packet}*.

71. Large objects have very short wavelengths when moving and thus can not be observed behaving as a wave. *(DeBroglie Waves)*
72. All electromagnetic waves originate from accelerating charged particles.
73. The frequency of a light wave determines its energy (E = hf).
74. The lowest energy state of a atom is called the ground state.
75. Increasing light frequency increases the kinetic energy of the emitted photo-electrons.
76. As the threshold frequency increase for a photo-cell (photo emissive material) the work function also increases.
77. Increasing light intensity increases the number of emitted photo-electrons but not their KE.

Internal Energy

78. Internal energy is the sum of temperature (ke) and phase (pe) conditions.
79. Steam and liquid water molecules at 100 degrees have equal kinetic energies.
80. Degrees Kelvin (absolute temp.) Is equal to zero (0) degrees Celsius.
81. Temperature measures the average kinetic energy of the molecules.
82. Phase changes are due to potential energy changes.
83. Internal energy always flows from an object at higher temperature to one of lower temperature.

Nuclear Physics

84. Alpha particles are the same as helium nuclei and have the symbol $^{4}_{2}He$.
85. The atomic number is equal to the number of protons (2 for alpha)
86. Deuterium ($^{2}_{1}H$) is an isotope of hydrogen ($^{1}_{1}H$)
87. The number of nucleons is equal to protons + neutrons (4 for alpha)
88. Only charged particles can be accelerated in a particle accelerator such as a cyclotron or Van Der Graaf generator.
89. Natural radiation is alpha ($^{4}_{2}He$), beta ($^{0}_{-1}e$) and gamma (high energy x-rays)
90. A loss of a beta particle results in an increase in atomic number.
91. All nuclei weigh less than their parts. This mass defect is converted into binding energy. ($E=mc^2$)
92. Isotopes have different neutron numbers and atomic masses but the same number of protons (atomic numbers).
93. Geiger counters, photographic plates, cloud and bubble chambers are all used to detect or observe radiation.
94. Rutherford discovered the positive nucleus using his famous gold-foil experiment.
95. Fusion requires that hydrogen be combined to make helium.
96. Fission requires that a neutron causes uranium to be split into middle size atoms and produce extra neutrons.

97. Radioactive half-lives can not be changed by heat or pressure.
98. One AMU of mass is equal to 931 meV of energy ($E = mc^2$).
99. Nuclear forces are strong and short ranged.

General

100. The most important formulas in the physics regents are:

$\bar{v} = \frac{\Delta s}{t}$ $v = \lambda f$ $KE = \frac{1}{2}mv^2$ $PE = mgh$

$F = ma$ $E = hf$ $V = IR$ $W = F\Delta s$

101. Physics is fun. (Honest!)