

# Physics 2020 Exam 3

## Review Items and Questions

### Dr. Luttermoser's Class

1. What is Hooke's Law? How is this related to simple harmonic motion? How does energy change with a simple harmonic oscillator (SHO)?
  2. When does a pendulum behave like a SHO? What is the period of such a pendulum?
  3. What is the difference between a transverse wave and a longitudinal wave?
  4. Review the summary of Chapter 13 in the textbook and learn the definition of all boldface terms in this chapter.
  5. Review Examples VII-1 (Hooke's law), VII-2 (oscillators), VII-4 (string vibrations) in the class notes. Finally, make sure you understand how to do the Supplemental Homework Problem Set 3: 2 (Hooke's law and energy), 3 (pendulums), and 4 (string vibrations).
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6. What are the 3 regimes of sound waves? How does the speed of sound in air change with temperature?
  7. What is sound intensity? What is the difference between the threshold of hearing and the threshold of pain? What is a decibel?
  8. Describe the Doppler Effect. What is a shock wave and how is it related to the Mach number?
  9. What is a standing wave? What is meant by harmonics and how are they related to the fundamental frequency?
  10. Review the summary of Chapter 14 in the textbook and learn the definition of all boldface terms in this chapter.
  11. Review Examples VIII-1 (velocity of sound), VIII-2 (decibel level), VIII-3 (spherical waves), VIII-4 (Doppler effect), VIII-5 (interference of sound waves), VIII-6 (standing waves), and VIII-7 (standing waves in air columns) in the class notes. Finally, make sure you understand how to do the Supplemental Homework Problem Set 3: 5 (speed of sound), 6 (decibel level), 8 (Doppler effect), 10 (vibrating strings), and 11 (resonance).
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12. What are Maxwell's equations? What do they say about magnetic monopoles? How are the electric field, magnetic field, and the speed of light related?
  13. What is the photoelectric effect?
  14. Why can't anything with mass travel at or faster than the speed of light?

15. What are the differences between an alpha, a beta, and a gamma particle? When are these seen?
  16. Compare the frequencies, energies, and momenta of a 3000 Å photon and a 9000 Å photon.
  17. What is the electromagnetic spectrum? List the regions of the electromagnetic spectrum from shortest wavelengths to longest wavelengths.
  18. What are Kirchoff's laws of spectrum formation? What is meant by a blackbody? How does the flux and color of a blackbody change with temperature? What is spectroscopy? Describe how Bohr explained 2 of the 3 types of spectra listed by Kirchoff.
  19. Review the summary of Chapter 21 in the textbook and learn the definition of all boldface terms in this chapter.
  20. Review Examples IX-1 (E/M waves), IX-2 (radio and visible light photon comparison), IX-3 (frequency from wavelength), IX-4 (Doppler effect of photons), and IX-5 (blackbody radiation). Finally, make sure you understand how to do the Supplemental Homework Problem Set 3: 13 (frequency-wavelength relationship).
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21. What is the difference between an intrinsic and extrinsic property of a particle?
  22. What is the Correspondence Principle and what is the principle of causality?
  23. What is the Heisenberg Uncertainty Principle? When does one apply it?
  24. What is the difference between an elementary particle and a field particle? What are the 4 natural forces of nature and which particles transmit these forces?
  25. What is the difference between a lepton, meson, and baryon? What is a hadron? What is the difference between a fermion and a boson?
  26. List the 6 different kinds of leptons and the 6 different types of quarks. What is the structure of a proton and a neutron in terms of quarks?
  27. What is quantum mechanics and quantum chromodynamics?
  28. What is a wave function and the Pauli Exclusion Principle?
  29. What is meant by the Standard Model of Particle Physics?
  30. List and define the 4 quantum numbers introduced in class.
  31. What is the difference between a bound-bound and a bound-free transition?
  32. What is the difference between a ground state and an excited state?
  33. What is the difference between absorption and scattering?
  34. Calculate the location of the H $\alpha$ , H $\beta$ , and H $\gamma$  lines in both vacuum and air wavelengths.

35. Calculate the energy (in eV) of the 1st excited state of ionized helium.
36. Review the summary of Chapter 28 in the textbook and learn the definition of all boldface terms in this chapter.
37. Review Examples X-1 (SV 28.3, atomic forces) and X-2 (SV 28.8, Bohr model of hydrogen). Make sure you understand CAPA Problem 3.9 (Bohr model of hydrogen). Finally, make sure you understand how to do the Supplemental Homework Problem Set 3: 14 (atomic forces) and 17 (SV 28.23, atomic orbits).