Acing the Physics GRE!

About the Physics GRE

Test-taking strategies

Getting ready

Practice, practice, practice!

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About the Physics GRE

- Subject tests are offered 3 times per year, in:
  - September (Sept 19 this year)
  - October (Oct 24 this year) – results should be available in time for grad. school applications
  - April (Apr 16 next year)
- Seniors usually take the Sept and/or Oct test
- Well-prepared juniors sometimes take the Apr test
- You may take the test multiple times – the *ScoreSelect* option allows you to select which test scores to send to a given institution
- You need to choose a convenient test location – some centers fill up quickly

About the Physics GRE

- Tests are administered by Educational Testing Service (www.ets.org) – their website has a lot of useful information – be sure to review it carefully
- You may register online (*My GRE*) or by mail – registration deadlines are typically a month prior to test date
- Test fee ($150) includes sending test scores to up to 4 institutions (additional $27 each) – you may request a fee reduction in cases of hardship (www.ets.org/gre/subject/about/fees/reduction/)
- Tests allow health- or disability- related accommodations
- Read the website carefully for other policies, e.g. on scores by phone, etc.

About the Physics GRE

- Test (paper-based) has very specific multiple-choice format:
  - 100 questions
  - 170 minutes (so about 1.5 minutes/question!)
  - No calculators
  - Brief sheet of constants, a few formulae – you will benefit from remembering fundamental formulae!
- You want to be fully familiar with every aspect of the format well in advance of your test
- Tests knowledge of key areas of undergraduate physics – your coursework and course textbooks are perhaps the best resources in preparing

About the Physics GRE

- You will want to practice extensively on prior Physics GRE tests – 5 are readily available (online search):
  - 1986
  - 1992
  - 1996
  - 2001
  - 2008
- Good idea initially to try one of these (maybe 2001 or 2008) under "test-taking conditions" to give you a feel for the test, and also to show your strong and weaker areas

Test-taking strategies

- Be completely familiar with the format of the test, including the answer "bubble" sheets, etc – you don't want to waste time finding your way around the test booklet on test day
- The questions are ordered randomly (in terms of topic) – some questions are grouped
- Some questions can be mostly quickly answered by looking at dimensional arguments, order-of-magnitude estimates or limiting behaviors… these 'tricks' will really help you
- There are blank pages for calculations, scratch work
- A good strategy is to make a first pass answering those questions you are confident about, returning for subsequent questions on a second (or third) pass

Test-taking strategies

- Scoring:
  - 5-option multiple choice format
  - All questions carry equal weight
  - No answer, or multiple answers, not counted
  - ¼ of number of incorrect answers deducted – totally random guessing may lower your score BUT if you can eliminate one or more answers, guessing from the remaining answers increases your odds
  - Scaled score from 200 to 990
- Don't wait until the very end to fill in your answers on the answer sheet!

Getting ready

- Obtain copies of all past Physics GRE tests
- Study format carefully
- Take one test under "realistic" conditions for calibration
- Undergrad. textbooks and course material probably the best preparation – thorough knowledge of an intro. course (e.g. Halliday) will take you a long way
- You may find it useful to compile your own summaries of material
- I don't find the prep. books available from commercial companies of much help ('Conquering the Physics GRE', by Kahn and Anderson is reasonable)
- AP Physics C free response problems are useful
- Case Western has some fun flashcards (www.phys.cwru.edu/flashcards)
- Form a study group
- Practice!
- There are online resources, e.g. grephysics.net that provide detailed solutions for old tests

Getting ready

- Content of the Physics test:
  - Classical Mechanics ~ 20%
  - E&M ~ 18%
  - Optics/waves ~ 9%
  - Quantum Mechanics ~ 12%
  - Atomic Physics (applied QM) ~ 10%
  - Thermal/statistical ~ 10%
  - Special Relativity ~ 6%
  - Specialized (nuclear, particle, condensed matter) ~ 9%
  - “Lab methods” (incl. statistics) ~ 6%

Getting ready

- Some of my preferred books:
  - Halliday, Resnick & Walker 'Fundamentals of Physics' (or similar) – a good knowledge of intro. physics will get you a fair way on the exam
  - Marion & Thornton 'Classical Dynamics' or Taylor 'Classical Mechanics'
  - Griffiths 'Intro. to Electrodynamics'
  - Griffiths 'Intro. to QM' or Gasioworicz 'Quantum Physics'
  - Schroeder 'Intro. to Thermal Physics'
  - Taylor 'Spacetime Physics'
  - For 'special topics' and lab methods, no obvious suggestions – try asking a local faculty member to give a short review
- But don't spend too much time with books (other than to review things you're unsure of, or to help compile your own review summaries)

Practice, practice,…!

- Start early
- Set yourself a schedule, maybe ordered by topic, and stick to it
- Do all of the sample exams
- Questions?

- Let's practice a bit…

GR8677 Q1 (Mechanics)

1. A rock is thrown vertically upward with initial speed v_0. Assume a friction force proportional to $-\mathbf{v}$, where $\mathbf{v}$ is the velocity of the rock, and neglect the buoyant force exerted by air. Which of the following is correct?

   (A) The acceleration of the rock is always equal to $\mathbf{g}$.

   (B) The acceleration of the rock is equal to $\mathbf{g}$ only at the top of the flight.

   (C) The acceleration of the rock is always less than $\mathbf{g}$.

   (D) The speed of the rock upon return to its starting point is v_0.

   (E) The rock can attain a terminal speed greater than v_0 before it returns to its starting point.

GR8677 Q2 (Mechanics)

2. A satellite orbits the Earth in a circular orbit. An astronaut on board perturbs the orbit slightly by briefly firing a control jet aimed toward the Earth's center. Afterward, which of the following is true of the satellite's path?

(A) It is an ellipse.
(B) It is a hyperbola.
(C) It is a circle with larger radius.
(D) It is a spiral with increasing radius.
(E) It exhibits many radial oscillations per revolution.

GR8677 Q3 (Waves)

3. For blue light, a transparent material has a relative permittivity (dielectric constant) of 2.1 and a relative permeability of 1.0. If the speed of light in a vacuum is c, the phase velocity of blue light in an unbounded medium of this material is

(A) $\sqrt{3.1}\,c$

(B) $\sqrt{2.1}\,c$

(C) $\frac{c}{\sqrt{1.1}}$

(D) $\frac{c}{\sqrt{2.1}}$

(E) $\frac{c}{\sqrt{3.1}}$

GR8677 Q4 (Waves)

4. The equation $y = A \sin 2\pi \left(\frac{t}{T} - \frac{x}{\lambda}\right)$, where A, T, and λ are positive constants, represents a wave whose

(A) amplitude is $2A$

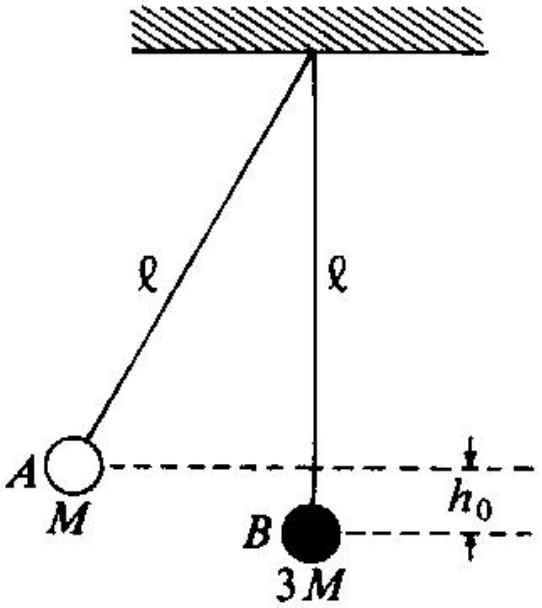
(B) velocity is in the negative x-direction

(C) period is $\frac{T}{\lambda}$

(D) speed is $\frac{x}{t}$

(E) speed is $\frac{\lambda}{T}$

GR8677 Q5 (Mechanics)



5. Two small spheres of putty, A and B, of mass M and $3M$, respectively, hang from the ceiling on strings of equal length ℓ. Sphere A is drawn aside so that it is raised to a height h_0 as shown above and then released. Sphere A collides with sphere B; they stick together and swing to a maximum height h equal to

(A) $\frac{1}{16}h_0$ (B) $\frac{1}{8}h_0$ (C) $\frac{1}{4}h_0$

(D) $\frac{1}{3}h_0$ (E) $\frac{1}{2}h_0$

GR8677 Q6 (Mechanics)

6. A particle is initially at rest at the top of a curved frictionless track. The x- and y-coordinates of the track are related in dimensionless units by $y = \frac{x^2}{4}$, where the positive y-axis is in the vertical downward direction. As the particle slides down the track, what is its tangential acceleration?

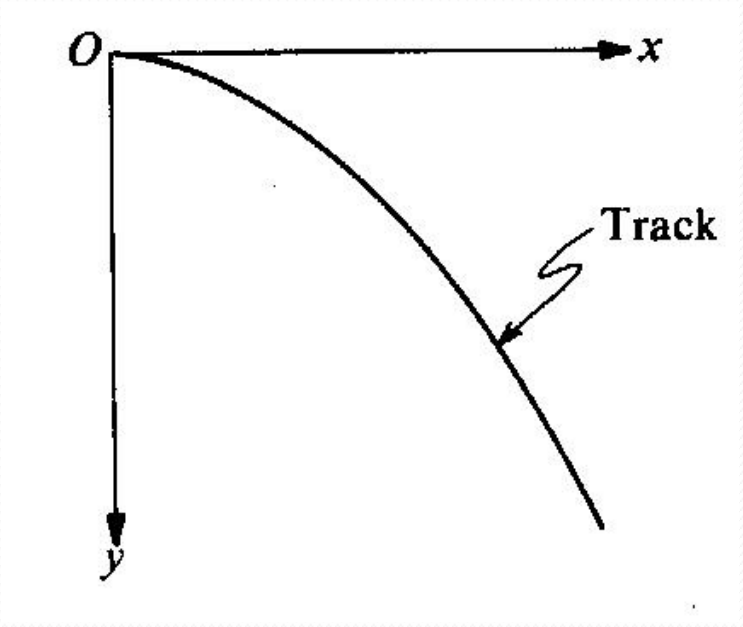
(A) 0

(B) g

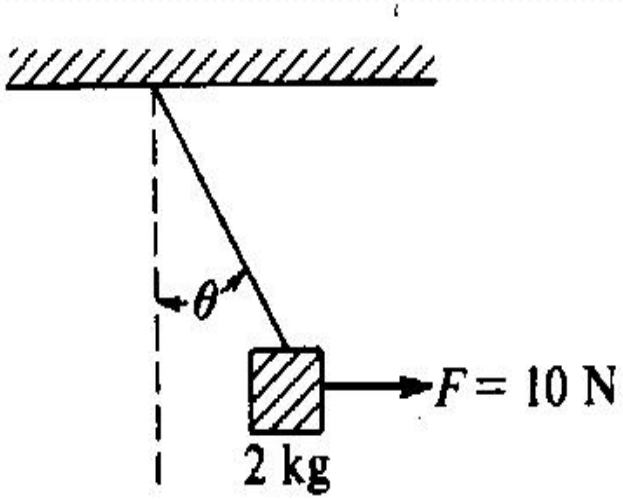
(C) $\frac{gx}{2}$

(D) $\frac{gx}{\sqrt{x^2+4}}$

(E) $\frac{gx^2}{\sqrt{x^2+16}}$



GR8677 Q7 (Mechanics)



7. A 2-kilogram box hangs by a massless rope from a ceiling. A force slowly pulls the box horizontally to the side until the horizontal force is 10 newtons. The box is then in equilibrium as shown above. The angle that the rope makes with the vertical is closest to

(A) arctan 0.5
(B) arcsin 0.5
(C) arctan 2.0
(D) arcsin 2.0
(E) 45°

GR8677 Q8 (Mechanics)

8. A 5-kilogram stone is dropped on a nail and drives the nail 0.025 meter into a piece of wood. If the stone is moving at 10 meters per second when it hits the nail, the average force exerted on the nail by the stone while the nail is going into the wood is most nearly

(A)	10	N
(B)	100	N
(C)	1000	N
(D)	10,000	N
(E)	100,000	N

GR8677 Q9 (E&M)

9. A wire of diameter 0.02 meter contains 1×10^{28} free electrons per cubic meter. For an electric current of 100 amperes, the drift velocity for free electrons in the wire is most nearly

(A) 0.6×10^{-29} m/s

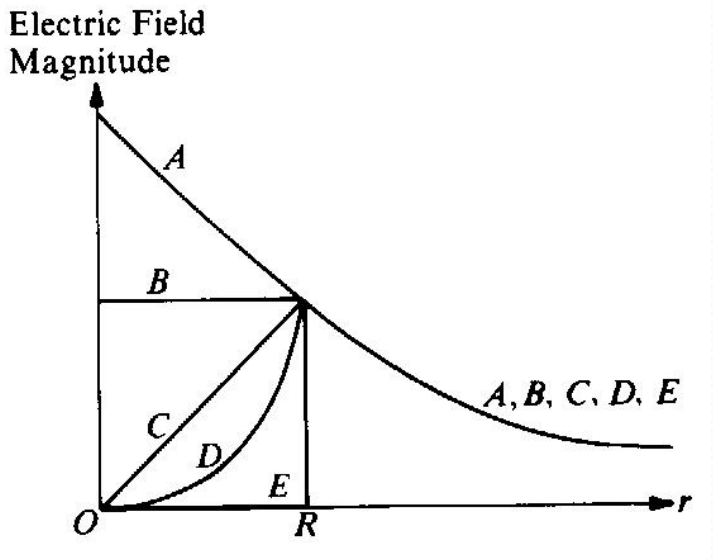
(B) 1×10^{-19} m/s

(C) 5×10^{-10} m/s

(D) 2×10^{-4} m/s

(E) 8×10^{3} m/s

GR8677 Q10 (E&M)



10. An isolated sphere of radius R contains a uniform volume distribution of positive charge. Which of the curves on the graph above correctly illustrates the dependence of the magnitude of the electric field of the sphere as a function of the distance r from its center?

(A) A (B) B (C) C (D) D (E) E

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