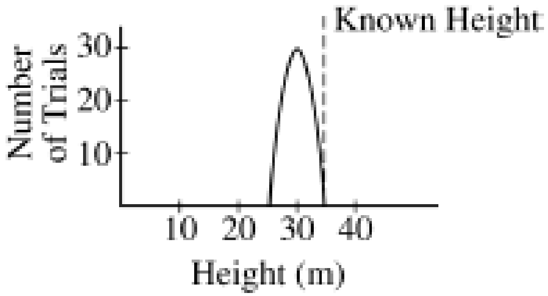
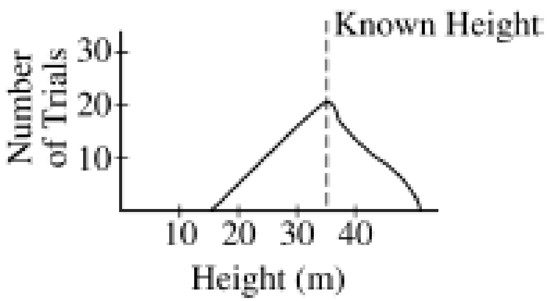
1. Five classes of students measure the height of a building. Each class uses a different method and each measures the height many different times. The data for each class are plotted below. Which class made the most precise measurement?

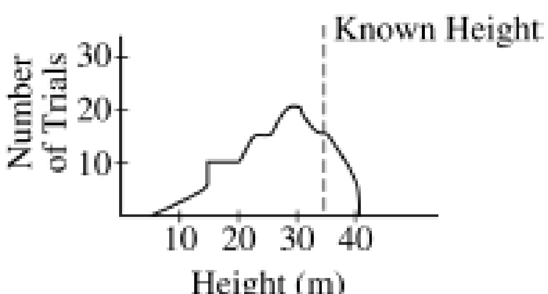
(A)



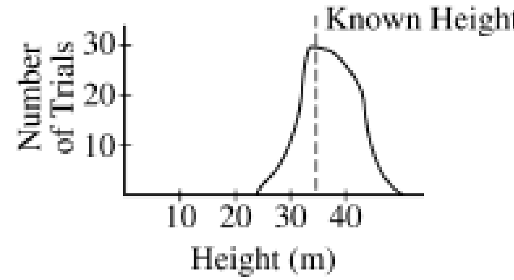
(B)



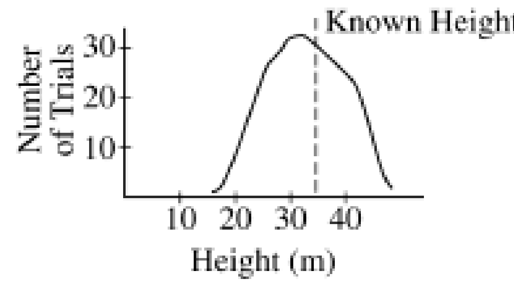
(C)



(D)



(E)



2. $$C = 3kN_A\left(\frac{h\nu}{kT}\right)^2 \frac{e^{h\nu/kT}}{(e^{h\nu/kT}-1)^2}$$

Einstein's formula for the molar heat capacity C of solids is given above. At high temperatures, C approaches which of the following?

(A) 0

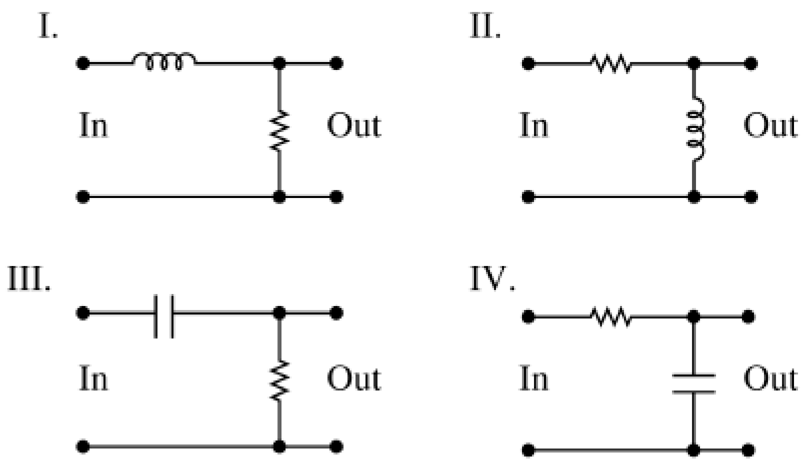
(B) $3kN_A\left(\frac{h\nu}{kT}\right)$

(C) $3kN_A h\nu$

(D) $3kN_A$

(E) $N_A h\nu$

3. Which two of the following circuits are high-pass filters?



(A) I and II
(B) I and III
(C) I and IV
(D) II and III
(E) II and IV

4. The raising and lowering operators for the quantum harmonic oscillator satisfy

$$a^\dagger\,|\,n\rangle = \sqrt{n+1}\,|\,n+1\rangle,\quad a|\,n\rangle = \sqrt{n}\,|\,n-1\rangle$$

for energy eigenstates $|\,n\rangle$ with energy E_n. Which of the following gives the first-order shift in the $n = 2$ energy level due to the perturbation

$$\Delta H = V(a + a^\dagger)^2,$$

where V is a constant?

(A) 0
(B) V
(C) $\sqrt{2}V$
(D) $2\sqrt{2}V$
(E) $5V$

http://www.ets.org/s/gre/pdf/practice_book_physics.pdf
From the 2014 version

5. A sealed and thermally insulated container of total volume V is divided into two equal volumes by an impermeable wall. The left half of the container is initially occupied by n moles of an ideal gas at temperature T. Which of the following gives the change in entropy of the system when the wall is suddenly removed and the gas expands to fill the entire volume?

(A) $2nR \ln 2$

(B) $nR \ln 2$

(C) $\frac{1}{2} nR \ln 2$

(D) $-nR \ln 2$

(E) $-2nR \ln 2$

6. The ground state electron configuration for phosphorus, which has 15 electrons, is

(A) $1s^2 2s^2 2p^6 3s^1 3p^4$

(B) $1s^2 2s^2 2p^6 3s^2 3p^3$

(C) $1s^2 2s^2 2p^6 3s^2 3d^3$

(D) $1s^2 2s^2 2p^6 3s^1 3d^4$

(E) $1s^2 2s^2 2p^6 3p^2 3d^3$

7. The Lagrangian for a mechanical system is

$$L = a\dot{q}^2 + bq^4,$$

where q is a generalized coordinate and a and b are constants. The equation of motion for this system is

(A) $\dot{q} = \sqrt{\frac{b}{a}} q^2$

(B) $\dot{q} = \frac{2b}{a} q^3$

(C) $\ddot{q} = -\frac{2b}{a} q^3$

(D) $\ddot{q} = +\frac{2b}{a} q^3$

(E) $\ddot{q} = \frac{b}{a} q^3$

8. In a nonrelativistic, one-dimensional collision, a particle of mass $2m$ collides with a particle of mass m at rest. If the particles stick together after the collision, what fraction of the initial kinetic energy is lost in the collision?

(A) 0

(B) $\frac{1}{4}$

(C) $\frac{1}{3}$

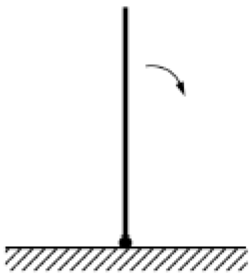
(D) $\frac{1}{2}$

(E) $\frac{2}{3}$

9. The mean kinetic energy of the conduction electrons in metals is ordinarily much higher than kT because

(A) electrons have many more degrees of freedom than atoms do
(B) the electrons and the lattice are not in thermal equilibrium
(C) the electrons form a degenerate Fermi gas
(D) electrons in metals are highly relativistic
(E) electrons interact strongly with phonons

10.



A thin uniform rod of mass M and length L is positioned vertically above an anchored frictionless pivot point, as shown above, and then allowed to fall to the ground. With what speed does the free end of the rod strike the ground?

(A) $\sqrt{\frac{1}{3}gL}$

(B) $\sqrt{gL}$

(C) $\sqrt{3gL}$

(D) $\sqrt{12gL}$

(E) $12\sqrt{gL}$