PhyzJob: Potential

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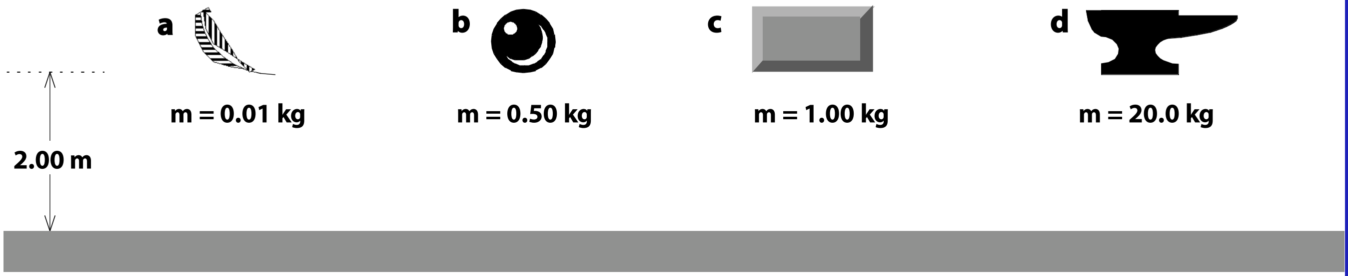
I. Gravitational Potential



1. Calculate the gravitational potential energy of each object shown (all are in the earth's gravitational field—use g = 10 m/s^2).

a.

PE = mgh
= 0.01kg·10m/s^2·2.0m
= 0.2J

b.

PE = mgh
= 0.5kg·10m/s^2·2.0m
= 10J

c.

PE = mgh
= 1.0kg·10m/s^2·2.0m
= 20J

d.

PE = mgh
= 20kg·10m/s^2·2.0m
= 400J

2. Gravitational potential indicates the amount of potential energy each unit of mass has at a given point in a gravitational field. Calculate the gravitational potential of each object shown.

a.

GP = gh
= 10m/s^2·2.0m
= 20J/kg

b.

GP = gh
= 10m/s^2·2.0m
= 20J/kg

c.

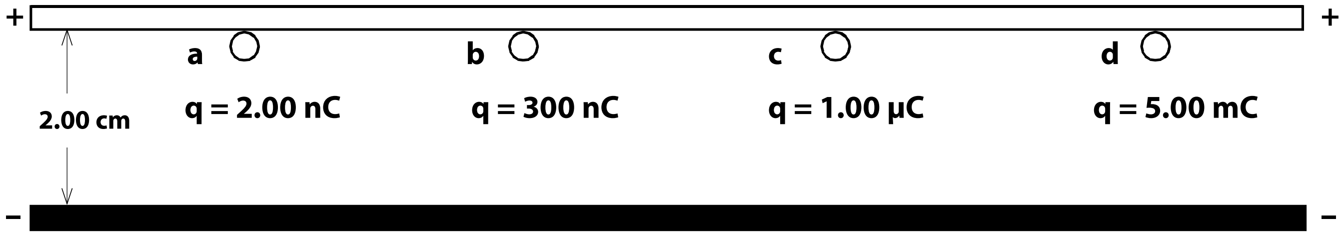
GP = gh
= 10m/s^2·2.0m
= 20J/kg

d.

GP = gh
= 10m/s^2·2.0m
= 20J/kg

3. Therefore, each kilogram of mass has ___20J___ of potential energy when placed at 2 m above the surface in the earth's gravitational field, and therefore loses ___20J___ of potential energy as it falls 2 m.

II. Electric Potential



4. Calculate the electric potential energy of each charge shown (all are immersed in a 1,000,000 N/C electric field).

a.
PE = qEd
= 2×10^{-9}C·1×10^{6}N/C·0.02m
= 4×10^{-5} J
= 40 μJ

b.
PE = qEd
= 300×10^{-9}C·1×10^{6}N/C·0.02m
= 6×10^{-3} J
= 6 mJ

c.
PE = qEd
= 1×10^{-6}C·1×10^{6}N/C·0.02m
= 0.02 J
= 20 mJ

d.
PE = qEd
= 5×10^{-3}C·1×10^{6}N/C·0.02m
= 100 J

5. Electric potential indicates the amount of potential energy each unit of charge has at a given point in an electric field. Calculate the electric potential of each charge shown.

a.
V = Ed
= 1×10^{6}N/C·0.02m
= 20,000 J/C
= 20 kV

b.
V = Ed
= 1×10^{6}N/C·0.02m
= 20,000 J/C
= 20 kV

c.
V = Ed
= 1×10^{6}N/C·0.02m
= 20,000 J/C
= 20 kV

d.
V = Ed
= 1×10^{6}N/C·0.02m
= 20,000 J/C
= 20 kV

6. Therefore, each coulomb of charge has __20,000 J__ of potential energy when placed at the positive plate (2 cm from the negative plate), and therefore loses __20,000 J__ of potential energy as it "falls" across that 2 cm gap.

7. If a single coulomb of charge passes from the + terminal to the – terminal of a 12 V battery, how much energy does it give up?

12 J