Answer on Question 48841, Physics, Other

Question:

The potential energy of a paricle in a field is $U = \frac{a}{r^2} - \frac{b}{r}$, where a and b are constant. The value of r in terms of a and b where force on a particle is zero will be:

(1) a/b

(2) b/a

(3) $2a/b$

(4) $2b/a$

Solution:

$$F = -\frac{dU}{dr},$$

So, substituting U and differentiating we obtain:

$$F = -\frac{d\left(\frac{a}{r^2} - \frac{b}{r}\right)}{dr} = -\left(-2ar^{-3} + br^{-2}\right) = \frac{b}{r^2} - \frac{2a}{r^3}.$$

When force on a particle is zero we obtain:

$$\frac{b}{r^2} - \frac{2a}{r^3} = 0,$$

From this expression we have $r = \frac{2a}{b}$.

Answer:

3) $r = \frac{2a}{b}$.