Answer on Question #39599, Physics, Other

Question:

Take the mass of the Earth to be 5.98 × 10^24 kg. If the Earth's gravitational force causes a falling 65 kg student to accelerate downward at 9.8m/s^2, determine the upward acceleration of the Earth during the students fall.

Answer:

Acceleration of the body equals:

$$a = \frac{F}{m}$$

where F is force, m is mass of the body.

From Newton's third law of motion the size of the forces on the Earth equals the size of the force on the student object. Therefore accelerations of student and Earth equal:

$$a_{Earth} = \frac{F}{m_{Earth}}$$

$$a_{student} = \frac{F}{m_{student}}$$

Therefore:

$$a_{Earth} = a_{student}\frac{m_{student}}{m_{Earth}} = 9.8\frac{m}{s^2}\frac{65kg}{5.98 * 10^{24}kg} = 1.07 \cdot 10^{-22}\frac{m}{s^2}$$

Answer: $1.07 \cdot 10^{-22}\frac{m}{s^2}$