

4th year

2. series

deadline

24.11.2008

FX [f:ks]

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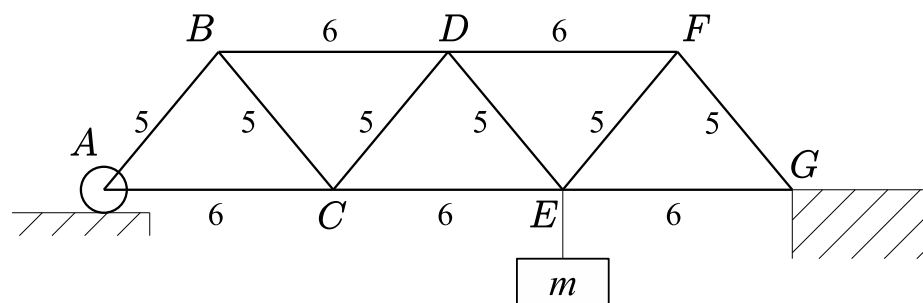
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FX4 Bridge

Katka built a bridge between the cupboard and the table. It is made of light rods connected by flexible joints, as in the picture. The lengths of the diagonal and horizontal rods are in ratio 5:6. A weight of mass m is suspended from point E . Which of the rods can be replaced by inextensible strings? What is the tension in the rod BD ?



FX5 Custard

Lenka made two pots of custard: a vanilla one and a chocolate one. The vanilla custard has heat capacity C_1 (in $\text{J}\cdot\text{K}^{-1}$) and temperature T_1 , the chocolate one has capacity C_2 and temperature T_2 . What is the maximum amount of energy in the form of macroscopic work that she can get out of these two pots of custard? (She cannot eat it in the process. Solve the problem quickly, before the custard gets cold!)

FX6 Amusing photons

Halucinka has a couple of photons in a good mood. Since her favourite electron has been sad and gloomy for a few days now, she decided to cheer it up: she sent a smiling photon of wavelength λ towards it. She was happy to find out that the electron did start to move after this encounter, although the sent photon was deflected by an angle θ and changed its wavelength. How do its new wavelength λ' and the kinetic energy E of the electron depend on the angle θ ?

After a while, another photon hit the moving electron. After this collision, the electron remained standing still and sad again, and the photon was deflected into the direction of the original motion of the first photon. What is the wavelength of the deflected photon?

Do not forget to take relativistic effects into account.