Dr. Sasha

Task N17

problem 2 – the problem is solved correctly.

problem 3 – the problem is solved correctly.

problem 4 – the problem is solved correctly.

problem 5 – the problem is solved correctly.

problem 6 – the problem is solved correctly.

Please, solve this problem and also show the steps to solve it.

12.06.2015 – N18

1) Magnetic resonance imaging needs a magnetic field strength of 1.5 T. The solenoid is 1.8 m long and 75 cm in diameter. It is tightly wound with a single layer of 2 mm-diameter superconducting wire. What size current is needed?

2) The density of ice is 917 kg/m^3. How much pressure you have to put on an ice cube to make it melt at -1°C?

Hint: Use the Clausius-Clapeyron relation

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3) Given the commutator algebra

$$\left[J_1, J_2\right] = iJ_3$$
$$\left[J_2, J_3\right] = iJ_1$$
$$\left[J_3, J_1\right] = iJ_2$$

Show that $J^2 = J_1^2 + J_2^2 + J_3^2$ commutes with J_3 ($\left[J^2, J_3\right] = 0$).

Hint: $\left[J_a, J_b\right] = J_a \cdot J_b - J_b \cdot J_a$

4) The line element in space is

$$ds^2 = -N^2 dt^2 + \left(r \cdot K\right)^2 \cdot \left[d\theta^2 + \sin\left(\theta\right)^2 \cdot \left(d\varphi - \omega dt\right)^2 \right] + \frac{dr^2}{1 - \frac{b}{r}},$$

where $N = K = 1 + \frac{16a^2 d \cos\left(\theta\right)^2}{r}$, $\omega = \frac{2a}{r^3}$ and $a,\ b,\ d$ are constants. Find covariant g_{ij} and contravariant g^{ij} components of the metric tensor.

Hint: $\sum_{j=1}^{4} g_{ij} \cdot g^{jk} = \delta_i^k$