Assignment 11

The due date for submitting this assignment has passed.

Due on 2021-04-07, 23:59 IST.

As per our records you have not submitted this assignment.

1) Consider two plasmas: plasma 1 has a plasma beta of $\beta_1 = 10$ and plasma 2 has a plasma beta of $\beta_2 = 1000$. Select the correct options with 1 point regard to the ratio of the sound speed $c_s$ to the Alfvén speed $c_A$ in the two plasmas.

- $c_s/c_A$ in plasma 1 will be 10 times its value in plasma 2
- $c_s/c_A$ in plasma 1 will be 0.1 times its value in plasma 2
- $c_s/c_A$ in plasma 1 will be 100 times its value in plasma 2
- $c_s/c_A$ in plasma 1 will be 0.01 times its value in plasma 2

No, the answer is incorrect.
Score: 0
Accepted Answers:
$c_s/c_A$ in plasma 1 will be 0.1 times its value in plasma 2

2) Consider the following form of the equation of motion in a plasma:

$$\rho \mathbf{v} \frac{d\mathbf{v}}{dt} = -\nabla P + \mathbf{J} \times \mathbf{B},$$

where $P$ is the gas pressure, and the current density $\mathbf{J}$ is given by $(\mathbf{1/\mu_0})(\nabla \times \mathbf{B})$. Now suppose you're told that the plasma $\beta$ is << 1. Pick the correct choices

- The Lorentz force will dominate over the force due to the gas pressure gradient
- The force due to the gas pressure gradient will dominate over the Lorentz force
- One cannot conclude anything about the dominance of the Lorentz force (in comparison to the force due to the gas pressure gradient)
- The force due to the gas pressure gradient will be equal to that due to the Lorentz force

No, the answer is incorrect.
Score: 0
Accepted Answers:
One cannot conclude anything about the dominance of the Lorentz force (in comparison to the force due to the gas pressure gradient)

3) Pick the correct choices with regard to the nature of Alfvén waves.

- Alfvén waves involve velocity, magnetic field and density perturbations
- Alfvén waves involve only velocity and magnetic field perturbations
- The velocity perturbations in Alfvén waves are orthogonal to the direction of wave propagation
- Alfvén waves propagating at an angle to the background magnetic field can have a non-zero phase velocity, as long as the angle is not 90 degrees

No, the answer is incorrect.
Score: 0
Accepted Answers:
Alfvén waves involve only velocity and magnetic field perturbations
The velocity perturbations in Alfvén waves are orthogonal to the direction of wave propagation
Alfvén waves propagating at an angle to the background magnetic field can have a non-zero phase velocity, as long as the angle is not 90 degrees

4) Pick the correct options

- Sound waves can exist in a fluid comprising charged particles (but is electrically neutral)
- Sound waves cannot exist in a fluid comprising charged particles (but is electrically neutral)
- Sound waves comprise density and velocity perturbations that are in the same direction as the wave propagation vector
- The density perturbations in sound waves are perpendicular to the direction of propagation for sound waves

No, the answer is incorrect.
Score: 0
Accepted Answers:
Sound waves can exist in a fluid comprising charged particles (but is electrically neutral)
Sound waves comprise density and velocity perturbations that are in the same direction as the wave propagation vector

5) We have discussed the basic features of dynamo mechanisms in astrophysics. Pick the correct statements with regard to dynamos:

- A dynamo amplifies small seed magnetic fields
- The amplification timescale for a dynamo needs to be smaller than the timescale for resistive decay of magnetic fields
- The amplification timescale for a dynamo needs to be larger than the timescale for resistive decay of magnetic fields
- The kinetic energy in large scale plasma motion is the basic energy source for a dynamo

No, the answer is incorrect.
Score: 0
Accepted Answers:
A dynamo amplifies small seed magnetic fields
The amplification timescale for a dynamo needs to be larger than the timescale for resistive decay of magnetic fields
The kinetic energy in large scale plasma motion is the basic energy source for a dynamo