Unit 14 - Week 12

Assignment 12

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2019-10-23, 23:59 IST.

1) One of the Maxwell equations has the form:

$$\nabla \times \mathbf{B} = \frac{4\pi}{c}\mathbf{J} + \frac{1}{c}\frac{\partial \mathbf{E}}{\partial t},$$

in Gaussian unit. Which term of this equation is not considered in magnetohydrodynamics (MHD)? *1 point*

- $\frac{4\pi}{c}\mathbf{J}$
- $\frac{1}{c}\frac{\partial \mathbf{E}}{\partial t}$
- $\nabla \times \mathbf{B}$
- $\frac{4\pi}{c}\mathbf{J} + \frac{1}{c}\frac{\partial \mathbf{E}}{\partial t}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{1}{c}\frac{\partial \mathbf{E}}{\partial t}$

2) In MHD, which of the following represents the total pressure? [B in CGS units] *1 point*

- $p + \frac{\mathbf{B}^2}{8\pi\rho}$
- $p + \frac{\rho^2}{8\pi\mathbf{B}}$
- $p + \frac{\rho^2}{8\pi\mathbf{B}}$
- $p + \frac{\mathbf{B}^2}{\pi\rho}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$p + \frac{\mathbf{B}^2}{8\pi\rho}$

3) In MHD, non-decaying Alfven waves are obtained for *1 point*

- incompressible condition.
- incompressible and dissipationless condition.
- incompressible, dissipationless and linearized condition.
- incompressible, dissipationless, diffusionless and linearized condition.

No, the answer is incorrect.
Score: 0
Accepted Answers:
incompressible, dissipationless, diffusionless and linearized condition.

4) In addition to the total energy, the other quadratic quantities that are conserved in MHD are *1 point*

- total magnetic energy
- total cross helicity
- total enstrophy
- total magentic helicity

No, the answer is incorrect.
Score: 0
Accepted Answers:
total cross helicity
total magentic helicity

5) In MHD, equation for the vorticity is *1 point*

$$\frac{d}{dt}\boldsymbol{\omega}(\mathbf{k}) + i\mathbf{k} \times \sum_{\mathbf{p}} \{\mathbf{u}(\mathbf{q}) \times \boldsymbol{\omega}(\mathbf{p})\} = \mathbf{F}_\omega(\mathbf{k}) - \nu k^2 \boldsymbol{\omega}(\mathbf{k}),$$

where $\mathbf{F}_\omega(\mathbf{k})$ is

- $i\mathbf{k} \times \sum_{\mathbf{p}} \{\mathbf{J}(\mathbf{q}) \times \mathbf{B}(\mathbf{p})\}$
- $i\mathbf{k} \times \sum_{\mathbf{p}} \{\mathbf{J}(\mathbf{p}) \times \mathbf{B}(\mathbf{q})\}$
- $i\mathbf{k} \times \sum_{\mathbf{p}} \{\mathbf{B}(\mathbf{q}) \times \mathbf{J}(\mathbf{p})\}$
- $\sum_{\mathbf{p}} \{\mathbf{J}(\mathbf{q}) \times \mathbf{B}(\mathbf{p})\}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$i\mathbf{k} \times \sum_{\mathbf{p}} \{\mathbf{J}(\mathbf{q}) \times \mathbf{B}(\mathbf{p})\}$

6) In hydrodynamics, Reynolds number is defined as $\frac{U_0 L}{\nu}$, where U_0 is large-scale velocity, L is system size and ν is kinematic viscosity. Which one of the following is the possible representation of the magnetic Reynolds number in magnetohydrodynamics?
(η is the magnetic diffusivity) *1 point*

- $\frac{U_0 L}{\nu\eta}$
- $\frac{U_0 L}{\nu}$
- $\frac{U_0 L}{\eta}$
- $\frac{U_0 L \eta}{\nu}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{U_0 L}{\eta}$

7) Let, $\mathbf{k}'$, $\mathbf{p}$ and $\mathbf{q}$ form a triad. The total energy transfer $S^{sb}(\mathbf{k}'|\mathbf{p},\mathbf{q})$ from modes $\mathbf{p}$ and $\mathbf{q}$ to the mode $\mathbf{k}'$ is *1 point*

- $\Im[\{\mathbf{k}' \cdot \mathbf{u}(\mathbf{q})\}\{\mathbf{B}(\mathbf{p}) \cdot \mathbf{B}(\mathbf{k}')\}] + \Im[\{\mathbf{k}' \cdot \mathbf{u}(\mathbf{p})\}\{\mathbf{B}(\mathbf{q}) \cdot \mathbf{B}(\mathbf{k}')\}]$
- $\Im[\{\mathbf{k}' \cdot \mathbf{B}(\mathbf{q})\}\{\mathbf{B}(\mathbf{k}') \cdot \mathbf{u}(\mathbf{p})\}] + \Im[\{\mathbf{k}' \cdot \mathbf{B}(\mathbf{p})\}\{\mathbf{B}(\mathbf{k}') \cdot \mathbf{u}(\mathbf{q})\}]$
- $\Im[\{\mathbf{k}' \cdot \mathbf{B}(\mathbf{q})\}\{\mathbf{B}(\mathbf{p}) \cdot \mathbf{u}(\mathbf{k}')\}] + \Im[\{\mathbf{k}' \cdot \mathbf{B}(\mathbf{p})\}\{\mathbf{B}(\mathbf{q}) \cdot \mathbf{u}(\mathbf{k}')\}]$
- $\Re[\{\mathbf{k}' \cdot \mathbf{B}(\mathbf{q})\}\{\mathbf{B}(\mathbf{p}) \cdot \mathbf{u}(\mathbf{k}')\}] + \Im[\{\mathbf{k}' \cdot \mathbf{B}(\mathbf{p})\}\{\mathbf{B}(\mathbf{q}) \cdot \mathbf{u}(\mathbf{k}')\}]$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\Im[\{\mathbf{k}' \cdot \mathbf{B}(\mathbf{q})\}\{\mathbf{B}(\mathbf{p}) \cdot \mathbf{u}(\mathbf{k}')\}] + \Im[\{\mathbf{k}' \cdot \mathbf{B}(\mathbf{p})\}\{\mathbf{B}(\mathbf{q}) \cdot \mathbf{u}(\mathbf{k}')\}]$

8) In terms of the variables u and b, we get total six possible fluxes. In contrast, in terms of Elsaser variables, how many fluxes do we get? *1 point*

- 1
- 2
- 6
- 4

No, the answer is incorrect.
Score: 0
Accepted Answers:
2

9) According to Kraichnan and Ironshinikov's model, energy spectrum of MHD turbulence is proportional to *1 point*

- $k^{-\frac{3}{2}}$
- $k^{-\frac{5}{3}}$
- $k^{-\frac{4}{3}}$
- $k^{-\frac{7}{2}}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$k^{-\frac{3}{2}}$

10) Third order structure function of MHD turbulence $\mathcal{S}^{\pm}_3(l)$ is *1 point*

- $-\frac{4}{3}\epsilon_{z^\pm} l$
- $-\frac{4}{5}\epsilon_{z^\pm} l$
- $-\frac{3}{2}\epsilon_{z^\pm} l$
- $-\frac{3}{5}\epsilon_{z^\pm} l$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$-\frac{4}{3}\epsilon_{z^\pm} l$