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Unit 10 - Week 9

Assignment 9

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

Due on 2018-10-03, 23:59 IST.

1) The expression for the gradient energy coefficient (κ_{ij}) in free energy functional is (γ and β have the same meaning as discussed in the lecture): ***1 point***

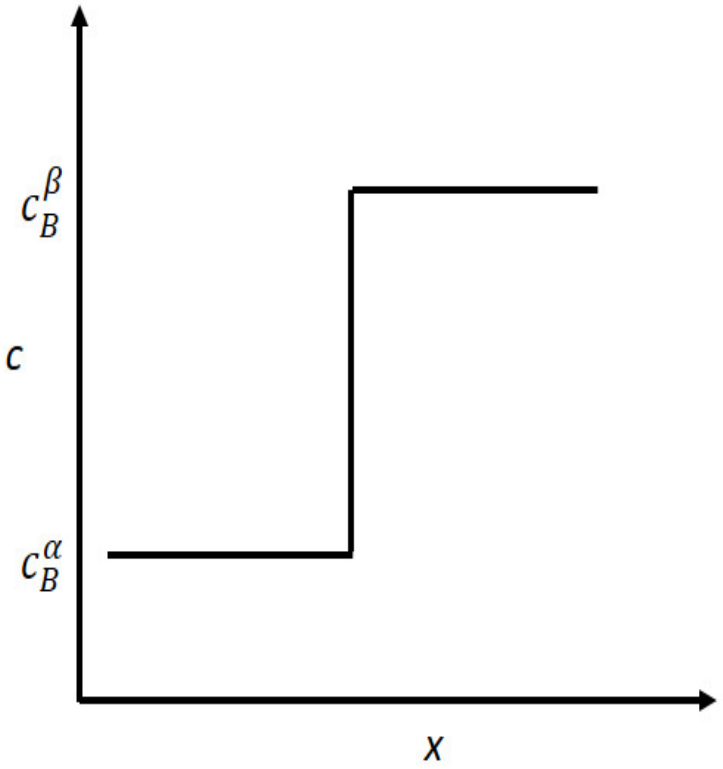
- $\kappa_{ij} = \frac{\gamma_{ij}}{2} - \frac{\partial \beta_{ij}}{\partial c}$
- $\kappa_{ij} = \frac{\gamma_{ij}}{2} + \frac{\partial \beta_{ij}}{\partial c}$
- $\kappa_{ij} = \frac{\gamma_{ij}}{2} \times \frac{\partial \beta_{ij}}{\partial c}$
- $\kappa_{ij} = \gamma_{ij} - \frac{\partial \beta_{ij}}{\partial c}$

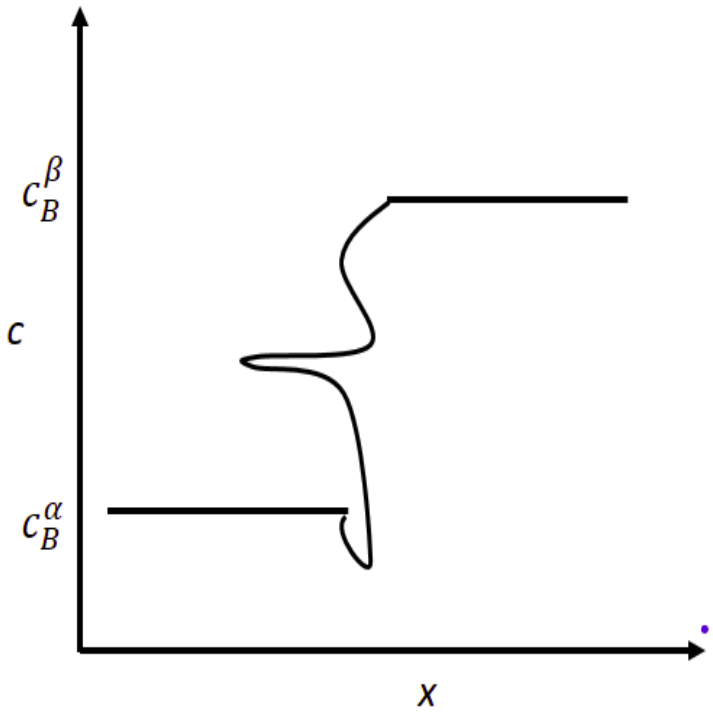
No, the answer is incorrect.
Score: 0

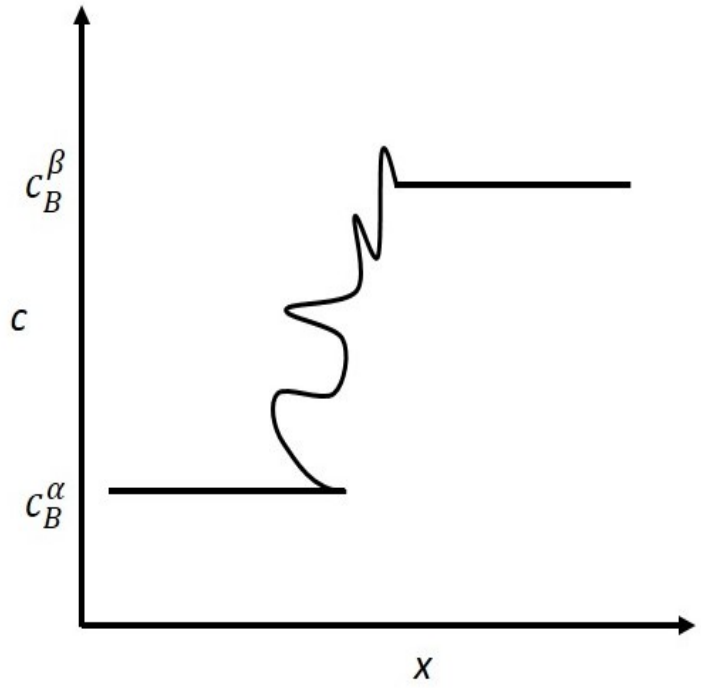
Accepted Answers:
$\kappa_{ij} = \frac{\gamma_{ij}}{2} - \frac{\partial \beta_{ij}}{\partial c}$

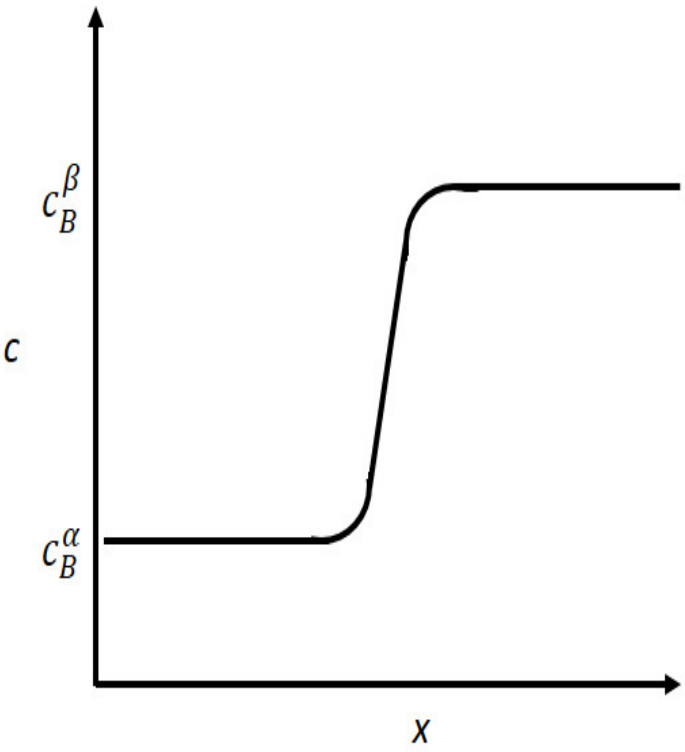
2) In a centrosymmetric crystal, the odd rank tensor term in a free energy functional is zero because: ***1 point***

- of inversion symmetry
- of rotational symmetry
- both (a) and (b)
- none of the above



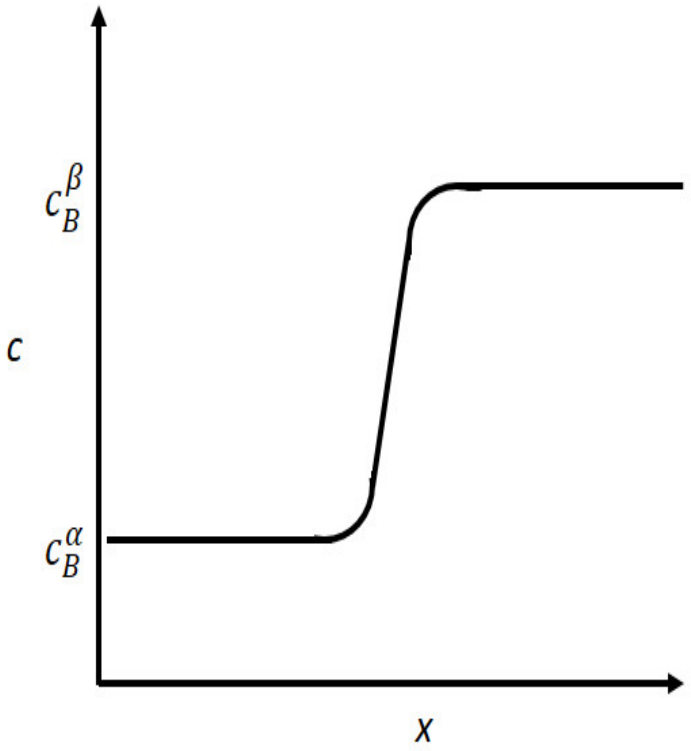






No, the answer is incorrect.
Score: 0

Accepted Answers:



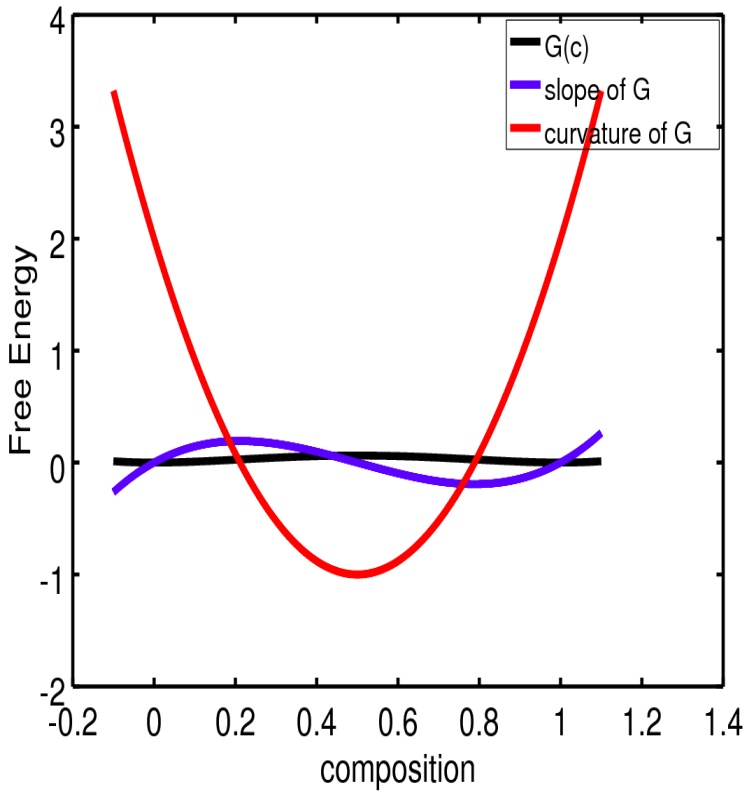
4) State whether true or false : "The expression for chemical potential is obtained by taking the variational derivative of the free energy functional"

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: String) true

1 point

5) Given below is a plot that includes the free energy, its first and second derivatives with respect to composition. Spinodal decomposition is expected to occur at some range of the composition, which can be identified from the plot. Looking at this plot, find out which of the following options represents the spinodal region? ***1 point***



(Note: (i) The double well shape of the G(c) curve looks linear due to the large difference in the magnitudes between the three parameters plotted, (ii) The composition axis has been plotted from -0.1 to 1.1 so that changes corresponding to the minima at 0 and 1 could be captured)

- 0 to 0.5
- 0.5 to 1.0
- 0.2 to 0.8
- 0 to 0.2, 0.8 to 1

No, the answer is incorrect.
Score: 0

Accepted Answers:
0.2 to 0.8

6) State whether the following statement is true or false: "There is a minimum limit of the wavelength of composition profiles that can undergo spinodal decomposition. This limit is set by the increasing contribution of free energy"

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: String) true

1 point

7) Which of the following code snippets is the correct way of implementing periodic boundary conditions in the spectral method of solving a 1-D differential equation: ***1 point***

```
for i = 1:n        # n is the number of points
w = i-1;
e = i+1;
if(w == 0) w = w + n;
endif
if(e == n+1) e = e - n;
endif
endfor
```

```
for i = 1:n        # n is the number of points
w = i-1;
e = i+1;
if(w == 0) w = w*i;
endif
if(e == n+1) e = e*(i-n);
endif
endfor
```

```
for i = 1:n        # n is the number of points
if(i<n/2) k = i*dk;  # dk  = 2*pi/n
endif
if(i>=n/2) k = (i-n)*dk;
endif
endfor
```

```
for i = 1:n        # n is the number of points
if(i<n/2) k = i + dk;  # dk  = 2*pi/n
endif
if(i>=n/2) k = (i-n) + dk;
endif
endfor
```

No, the answer is incorrect.
Score: 0

Accepted Answers:
for i = 1:n # n is the number of points
*if(i<n/2) k = i*dk; # dk = 2*pi/n*
endif
*if(i>=n/2) k = (i-n)*dk;*
endif
endfor

8) In the polynomial expression for double well, $G = Ac^2(1-c)^2$, the height of the barrier between the two minima is determined by: ***1 point***

- the distance between the two minima on the c axis.
- value of c at which maxima occurs
- value of A
- the height of the barrier will remain constant, i.e irrespective of A or c.

No, the answer is incorrect.
Score: 0

Accepted Answers:
value of A

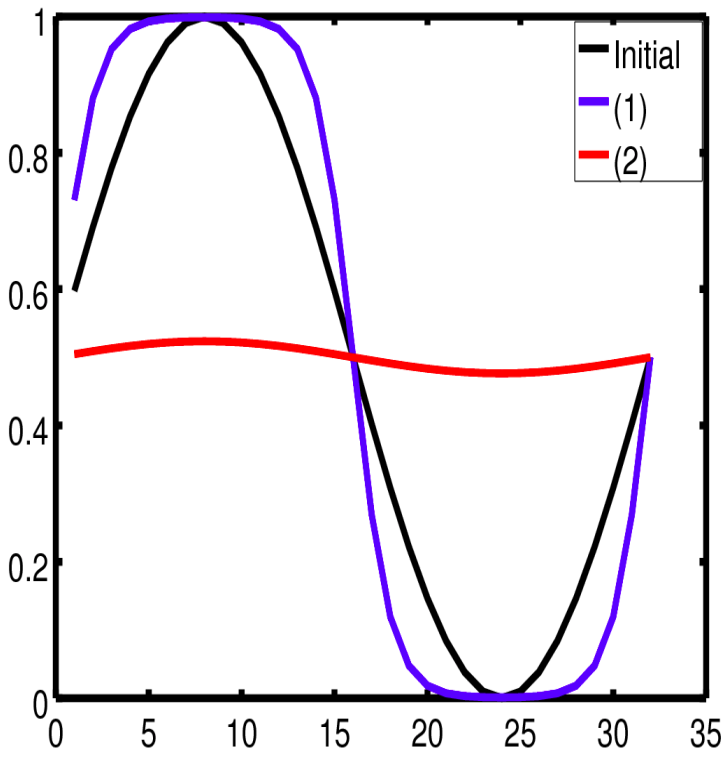
9) Unlike diffusion equation, the fully implicit implementation of the Cahn-Hilliard equation is far too involved because of the : ***1 point***

- fourth derivative of composition term
- nonlinear polynomial term in composition
- both the nonlinear polynomial term and fourth derivative term
- it is not true that a fully implicit implementation of Cahn-Hilliard equation is complicated.

No, the answer is incorrect.
Score: 0

Accepted Answers:
nonlinear polynomial term in composition

10) The following figure shows an initial composition profile, which is sinusoidal in nature, and two profiles labelled 1 and 2, which are obtained some time after the evolution of the initial profile due to diffusion. Which of these two curves correctly describes the composition profile that undergoes spinodal decomposition? ***1 point***



- Profile 1
- Profile 2
- Neither

No, the answer is incorrect.
Score: 0

Accepted Answers:
Profile 1

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