

Quiz-2

T: True, F: False, See the bold text for correct answers

1. Assuming the temperature variation within the Earth is caused by self-adiabatic compression, the temperature gradient at depth 200km is (assume the coefficient of thermal expansion is at constant pressure $\alpha_p = 2 \times 10^{-5} \text{ K}^{-1}$, $T = 1600\text{K}$ and the specific heat at constant pressure is $c_p = 1.3 \text{ kJ kg}^{-1}\text{K}^{-1}$). **Marks: 2**
a) 0.35Kkm^{-1} b) **0.25Kkm^{-1}** c) 0.15Kkm^{-1} d) 0.20Kkm^{-1}
2. In a heat-flow province the heat production by the radioactive sources is 101Wkg^{-1} . Assuming the radioactive heat flow is only due to a layer of thickness H escaping vertically, the value of H is (assume the density of the layer to be 2650 kg/m^3 , reduced heat flow and total heat flow of the province is 33mWm^{-2} and 86mWm^{-2} , respectively). **Marks: 2**
a) 22.6 km b) 17.2 km c) 24.5 km d) **19.8 km**
3. According to the Global Depth and Heat Flow model (GDH1), the heat flow at a location in the ocean of lithospheric age 50 Ma is **Marks: 2**
a) **75mWm^{-2}** b) 72mWm^{-2} c) 69mWm^{-2} d) 66 mWm^{-2}
4. The amount of depression of the spinel-perovskite phase boundary in a subducting oceanic lithosphere is (assume the slope of the Clapeyron curve is 2.1 MPa K^{-1} , density of the lithosphere is 3500 kg-m^{-3} , acceleration due to gravity is 10 ms^{-2} and the maximum temperature difference across the slab is 800 K). **Marks: 3**
a) 46
b) 47
c) **48**
d) 49
e) None of the above
5. If the value of dynamic viscosity is 10^{21} Pa-sec , density is 5.5 kg/m^3 and thermal diffusivity is $2.5 \times 10^{-6} \text{ m}^2/\text{sec}$, the Prandtl number for the mantle is **Marks: 2**
a) 0.27×10^{25} b) 1.27×10^{25} c) **7.27×10^{25}** d) 5.27×10^{25}
6. The temperature difference of both the upper and lower boundaries of the upper mantle (thickness: 630 km) is 1000°C , the value of the volume coefficient of thermal expansion of the material in the upper mantle is $2 \times 10^{-5}/^\circ\text{C}$, thermal diffusivity is $10^{-6} \text{ m}^2/\text{sec}$, kinematic viscosity is $3 \times 10^{17} \text{ m}^2/\text{sec}$. If there is no heat flow through its lower boundary, and no internal heat generation, the Rayleigh number in the upper mantle is **Marks: 3**
a) **1.66×10^5** b) 2.0×10^6 c) 2.66×10^5 d) 3.66×10^6 e) None of the above
7. Inner arc volcanic source zone is associated with the convection cell in the mantle wedge. **T** **Marks: 1**
8. Conrad discontinuity is invariably found around the globe. **F** **Marks: 1**
9. The dimension of the ratio of thermal diffusivity and dynamic viscosity is a unit less quantity. **F** **Marks: 1**
10. Olivine-spinel boundary is sharper than spinel-perovskite boundary against seismic waves inside the Earth. **F** **Marks: 1**
11. Pressure induced flow is more dominant in the hydrocarbon reservoir. **T** **Marks: 1**
12. Which of the following is the correct statement for perturbing the continental heat flow: **Marks: 1**
a) Pleistocene glaciation b) Neo-tectonics c) Hydrothermal circulation d) Thickening of crust e) **All of these**
13. Sealing age of oceanic lithosphere is usually found between **Marks: 1**
a) 45 – 55 Ma b) **55 -70 Ma** c) 70 – 85 d) 30 – 45 Ma

14. Finite half space model is less reliable than half space model for computing the bathymetry and heat flow in the oceanic lithosphere. **F** **Marks: 1**

15. Melting point temperature gradient is more than the real temperature gradient at the Gutenberg discontinuity. **T** **Marks: 1**

16. If the velocity of the flow in the lower mantle is 6.0 cm/yr, density of the flowing material is 6000 kg/m^3 , the dynamic viscosity is $2 \times 10^{21} \text{ Pa-s}$, and the thickness of the lower mantle is 2200 km, The Reynolds number is of the order of **Marks: 3**

a) 10^{-22}

b) 10^{-21}

c) 10^{-20}

d) 10^{-19}