# Atmospheric and Oceanic Sciences (XE-H)

**Question Number : 144** **Correct : 1 Wrong : -0.33**

Rossby Number is the ratio of

(A) Coriolis Force to Inertial Force
(B) Inertial Force to Coriolis Force
(C) Gravitational Force to Coriolis Force
(D) Viscous Force to Inertial Force

**Question Number : 145** **Correct : 1 Wrong : -0.33**

Kuroshio Current and Gulf Stream are

(A) EBC, WBC (B) EBC, EBC (C) WBC, WBC (D) WBC, EBC

[WBC: Western Boundary Current, EBC: Eastern Boundary Current]

**Question Number : 146** **Correct : 1 Wrong : 0**

The velocity of a tsunami wave in an ocean basin of depth 1 km is _____ $m\ s^{-1}$

[Density of seawater: 1025 $kg\ m^{-3}$, g: 10 $m\ s^{-2}$]

**Question Number : 147** **Correct : 1 Wrong : -0.33**

A thin iceberg is observed to move southeastward in the Arctic Ocean. If the surface current is wind driven, the prevailing wind is

(A) Easterly (B) Northerly (C) Southerly (D) Westerly

**Question Number : 148** **Correct : 1 Wrong : -0.33**

Equatorial Kelvin and Rossby waves respectively propagate

(A) Westward and Eastward
(B) Eastward and Westward
(C) Westward and Westward
(D) Eastward and Eastward

**Question Number : 149** **Correct : 1 Wrong : -0.33**

The largest contributor to the atmospheric greenhouse effect is

(A) $CO_2$ (B) $N_2$ (C) $CH_4$ (D) $H_2O$

**Question Number : 150** **Correct : 1 Wrong : -0.33**

If $T_v$, $T$, $T_w$ and $T_d$ denote virtual, dry bulb, wet bulb and dew point temperatures of a moist air parcel, then the correct order of their values is

(A) $T_v > T > T_w > T_d$
(B) $T_v \geq T \geq T_w \geq T_d$
(C) $T_v > T \geq T_w \geq T_d$
(D) $T > T_v > T_w > T_d$

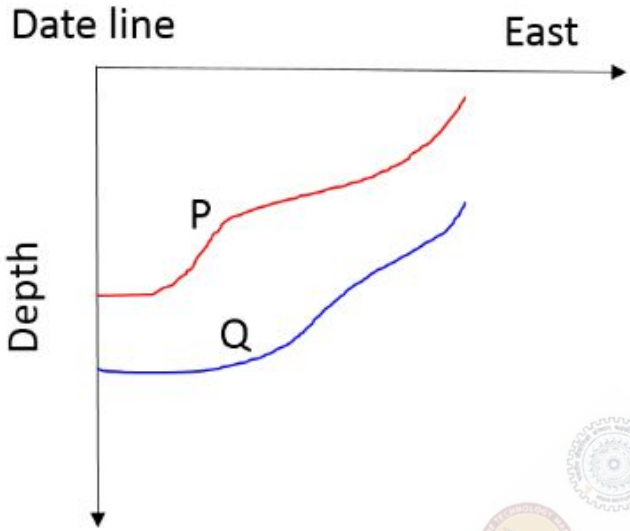
**Question Number : 151** **Correct : 1 Wrong : -0.33**

Burning of fossil fuel is increasing the concentration of $CO_2$ in the atmosphere. A consequence of this is

(A) Ocean water which is presently basic will drift towards pH neutral
(B) Ocean water which is presently acidic will become more acidic
(C) No effect on ocean pH
(D) Ocean water which is presently slightly basic will become more basic

## Question Number : 152 Correct : 1 Wrong : -0.33

Mixed layer depths measured in the Pacific Ocean in two different years are schematically shown in the figure below.




Years P and Q belong to

(A) P: El-Nino, Q: La-Nina
(B) P: La-Nina, Q:El-Nino
(C) P: El-Nino, Q: QBO
(D) P: QBO, Q: La-Nina

## Question Number : 153 Correct : 2 Wrong : 0

Average surface temperatures of the Sun and the Earth are 6300 K and 285 K, respectively. The ratio of the wavelength of peak radiation of the Earth to that of the Sun is _____.

## Question Number : 154 Correct : 2 Wrong : 0

In the month of April, the mixed layer in the Arabian Sea received a net heat flux of 50 W $m^{-2}$. If the mixed layer depth is 50 m, the increase in temperature at the end of April is _____ °C.

[Density of seawater: 1025 kg $m^{-3}$, Density of freshwater: 1000 kg $m^{-3}$, Specific heat of seawater: 4200 J $kg^{-1}$ $K^{-1}$, Latent heat of evaporation: 2.45 × $10^6$ J $kg^{-1}$]

## Question Number : 155 Correct : 2 Wrong : 0

The thickness of an atmospheric layer between 600 hPa and 500 hPa is 1.5 km. If the layer is isothermal, then its temperature is_____ K.

[Gas constant of air: 287 J $kg^{-1}$ $K^{-1}$, g: 10 m $s^{-2}$]

## Question Number : 156 Correct : 2 Wrong : -0.66

At 17°N, a mass of fluid is moving under geostrophic balance at 0.3 m $s^{-1}$ towards east. Suddenly the pressure gradient force becomes zero. Then the fluid will

(A) continue to move towards the east at 0.3 m $s^{-1}$
(B) undergo circular motion with radius of about 17 km
(C) undergo circular motion with radius of about 7 km
(D) move southward

[Angular velocity of the Earth: $7.27 \times 10^{-5}$ rad $s^{-1}$]

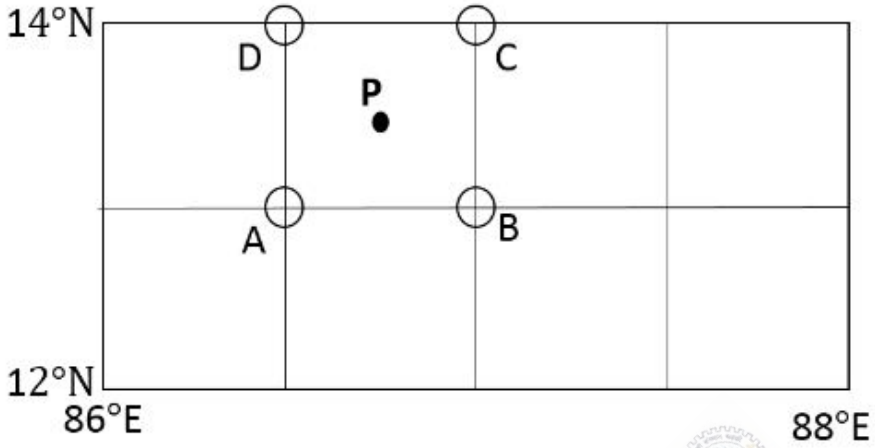
## Question Number : 157 Correct : 2 Wrong : 0

At 45°N, wind is blowing northward and its magnitude decreases eastward from 10 m $s^{-1}$ to 1 m $s^{-1}$ over a distance of 18 km. The absolute vorticity of the flow is _____ $\times 10^{-4}$ $s^{-1}$.

[Angular velocity of the Earth: $7.27 \times 10^{-5}$ rad $s^{-1}$]

**Question Number : 158** **Correct : 2 Wrong : 0**

Sea surface height anomalies at the locations A, B, C and D are -10, -15, 5 and 0 cm respectively.




The magnitude of geostrophic velocity at P is _____ m $s^{-1}$.
[Take 1° = 100 km, g = 10 m $s^{-2}$, Angular velocity of the Earth: 7.27 × $10^{-5}$ rad $s^{-1}$]

**Question Number : 159** **Correct : 2 Wrong : 0**

In a severe tropical cyclone, 250 mm of rainfall occurs in an area having a radius of 200 km. If the energy supplied to the system from this rainfall is N times the energy of one atomic bomb (=1.5× $10^{15}$ kJ), then the value of N is _____.

[Density of freshwater: 1000 kg $m^{-3}$, Specific heat of seawater: 4200 J $kg^{-1}$ $K^{-1}$, Latent heat of evaporation: 2.45 × $10^{6}$ J $kg^{-1}$]

**Question Number : 160** **Correct : 2 Wrong : -0.66**

A student wants to numerically solve the linear 1-D advection equation $\frac{\partial \varphi}{\partial t} + c\frac{\partial \varphi}{\partial x} = 0$, where $c = 300$ m $s^{-1}$. The value of the maximum time-step the student can consider according to CFL criterion for a spatial resolution of 3 km is

(A) 15 s (B) 10 s (C) 25 s (D) 20 s

**Question Number : 161** **Correct : 2 Wrong : -0.66**

Planets in the solar system are in radiative equilibrium. Let $S_0$, $\alpha$, $T_0$ and $R$ denote solar constant, albedo, average temperature and radius of a planet, respectively, and $\sigma$ is Stefan's constant. Then the energy balance of this planet is given by the expression

(A) $(1-\alpha)\, S_0 = 4\,\sigma\, T_0^4$

(B) $(1-\alpha)\, S_0 = 2\,\sigma\, T_0^4$

(C) $\alpha\, S_0 = \sigma\, T_0^4$

(D) $\pi\, R^2\, (1-\alpha)\, S_0 = 4\,\sigma\, T_0^4$

**Question Number : 162** **Correct : 2 Wrong : 0**

A cumulonimbus cloud forms by an air parcel rising from the sea level with an initial temperature and specific humidity of 27°C and 20 gm $kg^{-1}$, respectively. Assume that moist static energy is conserved in this cloud. Then the cloud temperature at an altitude of 15 km is _____ K.

[Specific heat of dry air at constant pressure: 1005 J $kg^{-1}$ $K^{-1}$, Specific heat of water vapour at constant pressure: 1850 J $kg^{-1}$ $K^{-1}$, $g = 10$ m $s^{-2}$, Latent heat of evaporation: $2.45 \times 10^6$ J $kg^{-1}$]

**Question Number : 163** **Correct : 2 Wrong : -0.66**

If $u_g$ and $v_g$ are respectively zonal and meridional components of a flow field in geostrophic balance, then the divergence of this flow is

(A) 0

(B) $\frac{u_g}{f}\frac{\partial f}{\partial x}$

(C) $-\frac{1}{\rho f}\frac{\partial^2 p}{\partial y^2}$

(D) $-\frac{v_g}{f}\frac{\partial f}{\partial y}$

[$x$, $y$, $f$, $p$, $\rho$ are zonal distance, meridional distance, Coriolis parameter, pressure and density, respectively]

**Question Number : 164** **Correct : 2 Wrong : -0.66**

During the Indian summer monsoon season, depressions do not intensify to tropical cyclones because

**P:** Indian sub-continent is very hot and large land-sea temperature difference pulls depressions quickly to land before they can intensify into cyclones.
**Q:** southwesterly winds at low level are not conducive for the formation of tropical cyclones.
**R:** SST cooling due to strong monsoonal winds prevents cyclone formation.
**S:** strong zonal wind shear during the monsoon season does not allow warm core formation.

Which of the above statement(s) is(are) correct

(A) **P** & **Q** (B) Only **R** (C) Only **S** (D) **R** & **S**

**Question Number : 165** **Correct : 2 Wrong : -0.66**

Which among the following statement(s) is (are) correct,

**P:** ENSO and El-Nino are the same and refer to the warming of Equatorial Eastern Pacific SST.
**Q:** ENSO is an atmosphere-ocean coupled phenomenon and El-Nino is its oceanic part.
**R:** ENSO is an atmospheric phenomenon and El-Nino is an oceanic phenomenon
**S:** ENSO is the oscillatory component of El-Nino having a period of 4.7 years.

(A) **P** & **R** (B) Only **Q** (C) **P**, **Q** and **S** (D) **R** & **S**

# General Aptitude

**Question Number : 166** **Correct : 1 Wrong : -0.33**

The event would have been successful if you _____ able to come.

(A) are (B) had been (C) have been (D) would have been

**Question Number : 167** **Correct : 1 Wrong : -0.33**

There was no doubt that their work was thorough.

Which of the words below is closest in meaning to the underlined word above?

(A) pretty (B) complete (C) sloppy (D) haphazard

## Question Number : 168 Correct : 1 Wrong : -0.33

Four cards lie on a table. Each card has a number printed on one side and a colour on the other. The faces visible on the cards are 2, 3, red, and blue.

Proposition: If a card has an even value on one side, then its opposite face is red.

The cards which MUST be turned over to verify the above proposition are

(A) 2, red (B) 2, 3, red (C) 2, blue (D) 2, red, blue

## Question Number : 169 Correct : 1 Wrong : -0.33

What is the value of $x$ when $81 \times \left(\frac{16}{25}\right)^{x+2} \div \left(\frac{3}{5}\right)^{2x+4} = 144$ ?

(A) 1 (B) -1 (C) -2 (D) Cannot be determined

## Question Number : 170 Correct : 1 Wrong : -0.33

Two dice are thrown simultaneously. The probability that the product of the numbers appearing on the top faces of the dice is a perfect square is

(A) 1/9 (B) 2/9 (C) 1/3 (D) 4/9

## Question Number : 171 Correct : 2 Wrong : -0.66

Bhaichung was observing the pattern of people entering and leaving a car service centre. There was a single window where customers were being served. He saw that people inevitably came out of the centre in the order that they went in. However, the time they spent inside seemed to vary a lot: some people came out in a matter of minutes while for others it took much longer.

From this, what can one conclude?

(A) The centre operates on a first-come-first-served basis, but with variable service times, depending on specific customer needs.
(B) Customers were served in an arbitrary order, since they took varying amounts of time for service completion in the centre.
(C) Since some people came out within a few minutes of entering the centre, the system is likely to operate on a last-come-first-served basis.
(D) Entering the centre early ensured that one would have shorter service times and most people attempted to do this.

**Question Number : 172** **Correct : 2 Wrong : -0.66**

A map shows the elevations of Darjeeling, Gangtok, Kalimpong, Pelling, and Siliguri. Kalimpong is at a lower elevation than Gangtok. Pelling is at a lower elevation than Gangtok. Pelling is at a higher elevation than Siliguri. Darjeeling is at a higher elevation than Gangtok.

Which of the following statements can be inferred from the paragraph above?

i. Pelling is at a higher elevation than Kalimpong
ii. Kalimpong is at a lower elevation than Darjeeling
iii. Kalimpong is at a higher elevation than Siliguri
iv. Siliguri is at a lower elevation than Gangtok

(A) Only ii (B) Only ii and iii (C) Only ii and iv (D) Only iii and iv

**Question Number : 173** **Correct : 2 Wrong : -0.66**

P, Q, R, S, T and U are seated around a circular table. R is seated two places to the right of Q. P is seated three places to the left of R. S is seated opposite U. If P and U now switch seats, which of the following must necessarily be true?

(A) P is immediately to the right of R
(B) T is immediately to the left of P
(C) T is immediately to the left of P or P is immediately to the right of Q
(D) U is immediately to the right of R or P is immediately to the left of T

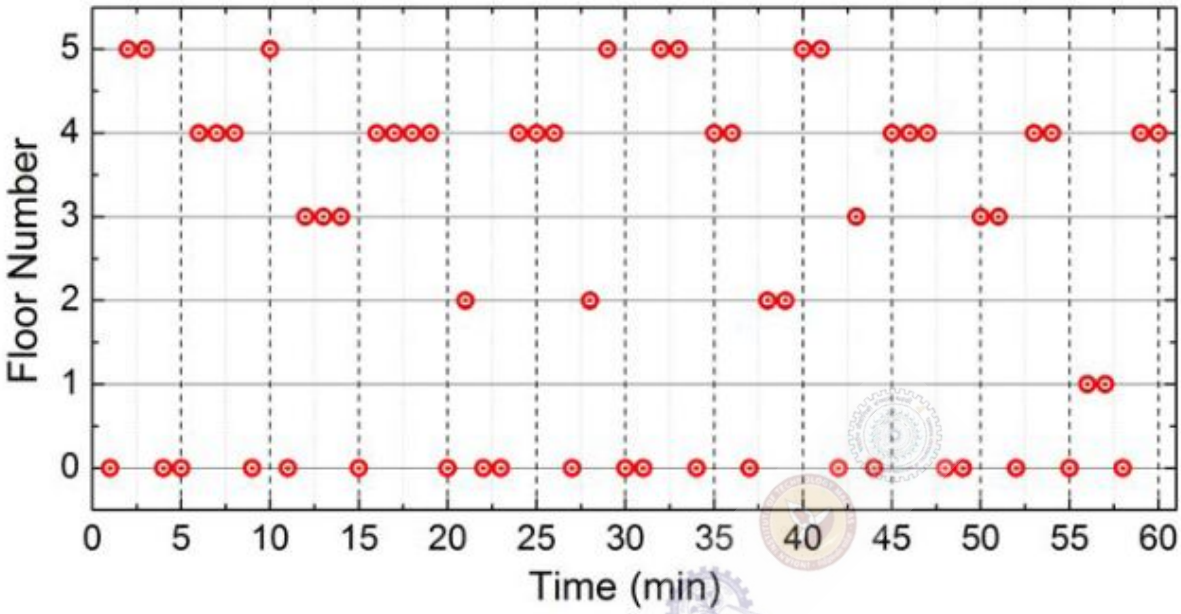
**Question Number : 174** **Correct : 2 Wrong : -0.66**

Budhan covers a distance of 19 km in 2 hours by cycling one fourth of the time and walking the rest. The next day he cycles (at the same speed as before) for half the time and walks the rest (at the same speed as before) and covers 26 km in 2 hours. The speed in km/h at which Budhan walks is

(A) 1 (B) 4 (C) 5 (D) 6

**Question Number : 175** **Correct : 2 Wrong : -0.66**

The points in the graph below represent the halts of a lift for durations of 1 minute, over a period of 1 hour.




Which of the following statements are correct?

i. The elevator never moves directly from any non-ground floor to another non-ground floor over the one hour period

ii. The elevator stays on the fourth floor for the longest duration over the one hour period

(A) ) Only i (B) Only ii (C) Both i and ii (D) Neither i nor ii