INDIA METEOROLOGICAL DEPARTMENT

TECHNICAL ASSISTANT – TECHNICAL EXAMINATION 2026

PRELIMINARY ANSWER KEY

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The following Preliminary Answer Key is issued for the Technical Assistant – Technical Examination 2026, conducted on 02 November 2026. Candidates may refer to the responses listed below. This document is provisional and subject to review and verification.

QUETIONS

SECTION I — ATMOSPHERIC THERMODYNAMICS

1. An air parcel initially at 300 K and 1000 hPa is lifted dry adiabatically to 800 hPa. Given the Poisson constant $\kappa = 0.286$, its approximate final temperature is:

A. 291.2 K

B. 286.0 K

C. 281.5 K

D. 276.1 K

2. The environmental lapse rate in a layer is 6°C km^{-1}. Assume the dry and saturated adiabatic lapse rates are approximately 9.8°C km^{-1} and 6°C km^{-1}, respectively. Which statement is most appropriate?

A. The atmosphere is absolutely unstable for both saturated and unsaturated parcels.

B. The atmosphere is absolutely stable for both saturated and unsaturated parcels.

C. The atmosphere is conditionally unstable because the environmental lapse rate exceeds the saturated adiabatic lapse rate.

D. The atmosphere is neutral for saturated parcels but stable for unsaturated parcels, under the stated approximations.

3. Two air parcels have identical pressure and actual temperature, but one contains more water vapour. Assuming ideal-gas behaviour, which statement best describes the moist parcel?

A. It has a lower virtual temperature and higher density.

B. It has a higher virtual temperature and lower density.

C. It has the same virtual temperature but a lower specific heat capacity.

D. Its density is independent of its water-vapour content.

4. A sounding exhibits large CAPE and substantial CIN. A strong synoptic-scale lifting mechanism subsequently raises the air parcel through the inhibition layer. Which outcome is physically most plausible?

A. Deep convection remains impossible because CIN cannot be overcome by lifting.
B. CAPE becomes zero as soon as the parcel begins ascending.
C. The parcel may reach its level of free convection and subsequently accelerate upward if positive buoyancy persists.
D. The parcel must become negatively buoyant immediately after reaching saturation.

5. The mean virtual temperature of an atmospheric layer increases while the pressure ratio between its bounding pressure surfaces remains constant. According to the hypsometric equation, the geopotential thickness of the layer will:

A. Increase.
B. Decrease.
C. Remain unchanged.
D. Become inversely proportional to the square of the mean virtual temperature.

6. An unsaturated air parcel rises without mixing or exchanging heat with its surroundings. Which combination correctly describes its initial ascent before reaching the lifting condensation level?

A. Temperature decreases at the moist adiabatic rate, while relative humidity remains constant.
B. Temperature decreases at the dry adiabatic rate, while its mixing ratio remains approximately constant.
C. Temperature decreases at the environmental lapse rate, while its saturation vapour pressure increases.
D. Temperature remains constant, while its specific humidity increases.

SECTION II — METEOROLOGICAL INSTRUMENTATION AND AWS

7. A platinum resistance thermometer and a thermistor are exposed to the same rapidly changing temperature field. Which consideration is most important when comparing their recorded temperature variations?

A. Their readings must be identical because both measure temperature electrically.
B. Their response depends exclusively on atmospheric pressure.
C. Their readings cannot be compared unless both instruments use mercury as a reference.
D. Their calibration characteristics, response times, thermal coupling and sampling intervals must be considered.

8. An AWS temperature sensor initially agrees with a calibrated reference instrument. Over three months, its reading gradually increases by 0.8°C, while the reference remains stable under comparable conditions. The most appropriate initial diagnosis is:

A. A genuine regional climate shift.

B. A systematic instrument drift requiring investigation and recalibration if confirmed.

C. Temporal aliasing caused exclusively by insufficient sampling frequency.

D. A change in the Coriolis parameter.

9. A tipping-bucket rain gauge records less precipitation than a nearby reference gauge during several episodes of intense rainfall. Both instruments appear operational. Which explanation is most technically defensible?

A. Intense rainfall cannot be measured using mechanical gauges.

B. The difference necessarily proves that the reference gauge is incorrectly calibrated.

C. Finite bucket-tipping time, mechanical losses, wind exposure and differences in spatial sampling may contribute to the discrepancy.

D. The tipping-bucket gauge measures rainfall duration rather than rainfall amount.

10. A wind vane exhibits excessive mechanical friction. During a gradual change in wind direction, the recorded direction changes only after the wind has turned substantially. This behaviour is best described as:

A. Instrument response lag, potentially accompanied by directional hysteresis.

B. A positive precipitation bias.

C. Doppler velocity aliasing.

D. A reduction in the atmospheric pressure-gradient force.

11. An AWS records a temperature of 28°C, followed by 67°C for one observation, and then 29°C. Nearby stations show no comparable temperature change. What is the best quality-control response?

A. Accept 67°C because automatic instruments eliminate observational errors.

B. Replace all observations from that station with the neighbouring station's values.

C. Delete the complete day's record immediately.

D. Flag the observation and investigate sensor condition, exposure, logger behaviour, transmission errors and independent observations before deciding whether to reject it.

12. A meteorological data logger samples a rapidly varying atmospheric signal at a frequency lower than twice the highest frequency present in the signal. Before any suitable anti-aliasing treatment, which problem may occur?

A. Systematic calibration becomes unnecessary.

B. The measured signal may misrepresent higher-frequency variations as lower-frequency variations.

C. Instrument drift is automatically eliminated.

D. The amplitude of every measured variation becomes exact.

SECTION III — ATMOSPHERIC DYNAMICS AND SYNOPTIC METEOROLOGY

13. At 30°N, calculate the approximate Coriolis parameter using:

$f = 2\Omega\sin\phi$

where $\Omega = 7.292 \times 10^{-5}\ \text{s}^{-1}$.

A. $2.5 \times 10^{-5}\ \text{s}^{-1}$
B. $1.46 \times 10^{-4}\ \text{s}^{-1}$
C. $7.29 \times 10^{-5}\ \text{s}^{-1}$
D. $7.29 \times 10^{-5}\ \text{s}^{-1}$

14. A strong horizontal temperature gradient exists across a frontal zone. Under approximate hydrostatic and geostrophic balance, which relationship is most directly used to diagnose the associated vertical variation of geostrophic wind?

A. Stefan–Boltzmann law.
B. Clausius–Clapeyron relationship.
C. Thermal-wind relationship.
D. Psychrometric equation.

15. In the Northern Hemisphere, an air parcel has positive relative vorticity. Ignoring complications associated with coordinate curvature, which interpretation is correct?

A. The horizontal wind field exhibits counterclockwise relative rotation.
B. The horizontal wind field must exhibit clockwise relative rotation.
C. The parcel must be moving vertically upward.
D. The atmospheric pressure must be increasing with time.

16. In a large-scale quasi-geostrophic setting, positive differential vorticity advection increasing with height is generally associated with which response, subject to the relevant dynamical assumptions?

A. Persistent subsidence in every atmospheric layer.
B. Upward motion.
C. Complete elimination of horizontal temperature gradients.
D. No possible vertical motion.

17. A mature extratropical cyclone is developing near a strong upper-level jet. Which combination most plausibly supports further surface cyclone intensification?

A. Uniform subsidence throughout the atmospheric column and the disappearance of temperature gradients.
B. Complete absence of upper-level wind variations and horizontal divergence.
C. Elimination of all baroclinicity and convergence.
D. Dynamically favourable upper-level divergence and associated mass redistribution, together with a suitable lower-tropospheric baroclinic environment.

18. A meteorologist identifies a strong horizontal temperature gradient and substantial vertical wind shear across a frontal region. Which interpretation best links these observations?

A. The atmosphere must be barotropic because horizontal temperature gradients suppress wind shear.
B. The thermal-wind relationship indicates that vertical geostrophic wind shear is associated with the horizontal temperature gradient.
C. The relationship proves that the surface wind is zero.
D. The observed shear must result exclusively from surface friction.

SECTION IV — INDIAN MONSOON AND TROPICAL CYCLONES

19. During an active southwest monsoon phase, central India experiences enhanced rainfall, while moisture transport from the Arabian Sea strengthens. Which combination provides the most physically consistent explanation?

A. Large-scale moisture convergence, favourable circulation and enhanced convective activity.
B. Complete suppression of atmospheric ascent and a uniform increase in surface pressure.
C. Elimination of the monsoon trough and disappearance of lower-tropospheric moisture.
D. Strong subsidence throughout the troposphere without any compensating ascent.

20. A monsoon break is observed over central India, while rainfall activity shifts towards the Himalayan foothills. Which interpretation is most appropriate?

A. The southwest monsoon circulation has necessarily disappeared throughout South Asia.
B. The Indian subcontinent has entered permanent winter conditions.
C. The altered monsoon circulation and the position or orientation of the monsoon trough can redistribute rainfall away from central India.
D. The change proves that atmospheric moisture is absent over the Arabian Sea.

21. Tropical cyclones rarely originate directly at the equator. Which physical factor most directly explains this limitation?

A. The complete absence of water vapour near the equator.
B. The very weak Coriolis effect near the equator, which limits the development of the required organized rotational circulation.
C. Permanently freezing sea-surface temperatures.
D. The absence of atmospheric pressure gradients throughout the equatorial region.

22. A tropical cyclone is over warm ocean water, but it encounters strong vertical wind shear and dry-air intrusion into its middle-level circulation. Which outcome is most likely?

A. Rapid intensification is guaranteed because the ocean is warm.
B. Vertical wind shear necessarily increases the symmetry of the eyewall.
C. Dry-air intrusion always increases latent heat release.
D. Intensification may be hindered because shear can disrupt the storm's vertical organization and dry air can weaken deep convection.

23. A coastal district is threatened by a severe tropical cyclone. Two locations have similar forecast maximum wind speeds, but one has a shallow continental shelf, a funnel-shaped coastline and a track directing strong onshore winds towards it. Which conclusion is most appropriate regarding storm surge?

A. Both locations must experience identical surge heights because wind speeds are similar.
B. Storm surge depends exclusively on central pressure.
C. The second location may experience a greater surge because wind stress, coastal geometry, bathymetry and storm characteristics jointly influence water-level rise.
D. Storm surge cannot occur without exceptionally heavy rainfall.

SECTION V — WEATHER RADAR AND SATELLITE METEOROLOGY

24. Under the Rayleigh-scattering approximation, radar reflectivity factor ZZ for a population of liquid precipitation drops is proportional to the sum of their diameters raised to which power?

A. First power.
B. Third power.
C. Fourth power.
D. Sixth power.

25. A Doppler weather radar measures radial velocities exceeding its unambiguous velocity limit. The displayed velocity field contains abrupt transitions between apparently unrelated velocity values. What is the most likely explanation?

A. Doppler velocity aliasing caused by the radar's sampling configuration.
B. A direct measurement of atmospheric temperature inversion.
C. Ground clutter caused exclusively by stationary buildings.
D. Automatic correction of all radial velocity errors.

26. During a severe storm, radar reflectivity decreases sharply behind an intense precipitation core, even though satellite imagery and other observations suggest precipitation continues farther downrange. Which radar limitation should be investigated first?

A. Excessive surface albedo.
B. Attenuation of the radar signal by intervening precipitation.
C. A decrease in the Earth's rotation rate.
D. A change in the station's geographical longitude.

27. A radar image shows a pronounced bright band near the atmospheric freezing level. Which microphysical process most directly explains this feature?

A. Complete evaporation of all hydrometeors above the freezing level.
B. Strong reflection from cloud-free air alone.
C. Enhanced radar reflectivity associated with melting snow or ice particles.
D. An automatic increase in radar transmitter power at the freezing level.

28. A meteorologist must monitor the rapid evolution of deep convection over the Bay of Bengal. Which satellite capability is generally most valuable for following changes in cloud-top temperatures and storm organization over short intervals?

A. A polar-orbiting satellite that observes the same location continuously without gaps.
B. Visible imagery alone during both day and night.
C. A satellite instrument that measures surface pressure directly at every pixel.
D. Frequent observations from a geostationary meteorological satellite, using suitable infrared imagery alongside other observations.

29. A satellite-derived atmospheric motion vector is generated by tracking a cloud feature across successive images. Which factor can introduce substantial uncertainty into the retrieved wind?

A. The cloud feature may evolve, change shape or represent a different atmospheric level from the one assumed in the retrieval.
B. The Earth's rotation stops affecting the atmosphere during image acquisition.
C. The tracked feature automatically provides the exact wind at every atmospheric level.
D. Satellite imagery contains no information about atmospheric motion.

SECTION VI — NUMERICAL WEATHER PREDICTION AND FORECAST VERIFICATION

30. In a numerical weather prediction model, the Courant–Friedrichs–Lewy condition is most directly concerned with:

A. The calibration of surface pressure sensors.
B. The relationship between time step, spatial grid spacing and the speed at which information propagates through the model.
C. The dependence of saturation vapour pressure on temperature.
D. The wavelength of satellite infrared radiation.

31. A numerical model has a horizontal grid spacing of 3 km. Deep convective processes occur at scales that are not adequately resolved by the model. Why might a convection parameterization still be required?

A. The parameterization replaces all governing equations with historical averages.
B. The parameterization eliminates the need for initial atmospheric observations.
C. The collective effects of unresolved convective processes must be represented in the resolved model equations.
D. The parameterization guarantees that every thunderstorm will be forecast at its exact location and time.

32. During data assimilation, observations differ from the model background. The observation-error covariance indicates that one observation has substantially greater uncertainty than another. In a statistically consistent assimilation system, the more uncertain observation will generally:

A. Receive greater weight because its uncertainty is larger.
B. Replace the entire model background automatically.
C. Be assigned infinite weight regardless of its departure from the background.
D. Receive less statistical weight, all else being equal.

33. An ensemble prediction system repeatedly produces a very narrow forecast spread, yet the observed atmospheric state frequently lies far outside the ensemble range. Which diagnosis is most appropriate?

A. The ensemble is underdispersive and may underestimate forecast uncertainty.
B. The ensemble is necessarily perfectly calibrated.
C. The forecast system has no initial-condition uncertainty.
D. The narrow spread proves that the ensemble mean is always correct.

34. A forecast system has a mean error close to zero but a substantially larger root mean square error. Which explanation is most plausible?

A. Every forecast is nearly exact.

B. Positive and negative errors partly cancel in the mean, while individual errors can still be large.

C. RMSE is independent of the magnitude of forecast errors.

D. The observations must all be identical.

35. A probabilistic forecasting system issues a 70% probability of rainfall exceeding a specified threshold on many occasions. Which finding would provide the strongest evidence that these forecasts are reliable?

A. Exactly 70% of all forecasts are issued during the monsoon season.

B. The forecast system never issues probabilities below 50%.

C. Approximately 70% of the cases assigned a 70% probability experience the specified event, based on a sufficiently large and representative sample.

D. The model's deterministic rainfall amount is always greater than the observed amount.

SECTION VII — BOUNDARY LAYER, RADIATION AND OPERATIONAL QUALITY CONTROL

36. A clear, calm night is followed by the formation of a strong near-surface temperature inversion. Which combination is most likely to occur near the ground?

A. Enhanced buoyancy-driven turbulence and rapid vertical dilution of pollutants.

B. Maximum convective mixing caused by intense solar heating.

C. Elimination of all vertical temperature gradients.

D. Reduced turbulent mixing, potentially increasing the accumulation of pollutants near the surface.

37. Two stations at similar elevations report substantially different temperatures during the passage of a rapidly developing thunderstorm. Which procedure is most scientifically appropriate before rejecting either observation?

A. Compare observation times, sensor exposure, calibration, station representativeness and independent evidence of local storm variability.

B. Automatically reject the higher temperature.

C. Replace both readings with the daily climatological mean.

D. Average the two readings without checking their quality or timing.

38. A surface energy-budget analysis shows that incoming solar radiation is partly reflected by the surface, while the remaining energy contributes to absorption and other surface-energy exchanges. Which quantity directly represents the fraction of incoming radiation reflected by the surface?

A. Emissivity.

B. Surface albedo.

C. Bowen ratio.

D. Atmospheric transmissivity.

39. A meteorological database combines hourly observations from stations that use different local time conventions, but the timestamps have no reliable time-zone metadata. What is the most serious immediate analytical risk?

A. An automatic increase in the temporal resolution of the dataset.

B. Elimination of all missing observations.

C. Incorrect temporal alignment, potentially distorting derived trends, spatial comparisons and forecast verification.

D. Guaranteed improvement in the accuracy of data assimilation.

40. During a rapidly evolving severe-weather event, an AWS measurement conflicts with a conventional instrument and observations from a nearby station. Which approach provides the strongest technical basis for validating the disputed measurement?

A. Accept the AWS reading because automated observations are inherently more accurate.

B. Accept the conventional instrument without considering its exposure or calibration.

C. Average the three measurements immediately, regardless of their timing or uncertainty.

D. Examine calibration, exposure, timestamps, sensor status, data transmission, spatial representativeness and independent observations before validating or rejecting the readings.

Examine calibration, exposure, timestamps, sensor status, data transmission, spatial

INDIA METEOROLOGICAL DEPARTMENT (IMD)

TECHNICAL ASSISTANT EXAMINATION

ADVANCED CHALLENGE SET — 10 MCQs

Difficulty Level: Very Hard
Total Questions: 10
Suggested Time: 25 Minutes
Maximum Marks: 10

Instructions: Select the single most appropriate answer for each question. Each question carries one mark.

Q.41. Atmospheric Thermodynamics

An unsaturated air parcel at 1000 hPa has a temperature of 303 K and a mixing ratio of 12 g kg^{-1}. It rises dry adiabatically to 800 hPa. Assume the Poisson exponent is 0.286 and the parcel remains unsaturated. Which pair gives the approximate final temperature and mixing ratio?

A) 284.3 K and 12 g kg^{-1}
B) 284.3 K and 7.7 g kg^{-1}
C) 288.6 K and 12 g kg^{-1}
D) 288.6 K and 7.7 g kg^{-1}

Q.42. Atmospheric Dynamics

At latitude 30° N, the meridional gradient of geostrophic zonal wind is $\partial u_g/\partial y = -2 \times 10^{-5}$ s^{-1}, while the zonal gradient of geostrophic meridional wind is $\partial v_g/\partial x = 1 \times 10^{-5}$ s^{-1}. Using the approximation that relative vorticity is $\zeta = \partial v/\partial x - \partial u/\partial y$, what is the relative vorticity?

A) -3×10^{-5} s^{-1}
B) -1×10^{-5} s^{-1}
C) $+1 \times 10^{-5}$ s^{-1}
D) $+3 \times 10^{-5}$ s^{-1}

Q.43. Synoptic Meteorology

In the Northern Hemisphere, an upper-level trough exhibits positive vorticity advection that increases with height. Under quasi-geostrophic assumptions, which vertical-motion response is generally favoured ahead of the trough?

A) Subsidence due to negative differential vorticity advection
B) Ascent due to positive differential vorticity advection
C) No vertical motion because geostrophic flow is non-divergent
D) Subsidence caused directly by the Coriolis force

Q.44. Radar Meteorology

For a weather radar operating under Rayleigh-scattering conditions, reflectivity factor is proportional to the sixth power of drop diameter: Z∝D6Z \propto D^6. If the diameter of an individual raindrop doubles while its number concentration remains unchanged, how does its contribution to reflectivity change?

A) 2 times
B) 8 times
C) 32 times
D) 64 times

Q.45. Numerical Weather Prediction

A numerical model uses a horizontal grid spacing of 5 km. The maximum wind speed along the grid direction is 25 m s^{-1}. Using the simplified one-dimensional advective CFL condition $C=|u|\Delta t/\Delta x \leq 1$, what is the largest permissible time step under this condition?

A) 50 seconds
B) 100 seconds
C) 200 seconds
D) 500 seconds

Q.46. Satellite Meteorology

A geostationary meteorological satellite observes a cloud system near the edge of its visible Earth disk. Compared with a similar cloud near the satellite's sub-satellite point, which effect is most likely?

A) The edge cloud is observed at a smaller viewing zenith angle.
B) The edge cloud has a shorter atmospheric path length through the satellite's line of sight.
C) The edge cloud is subject to greater geometric distortion and a longer atmospheric viewing path.
D) The edge cloud necessarily has a higher infrared brightness temperature.

Q.47. Indian Monsoon

During an active phase of the Indian summer monsoon, the monsoon trough shifts northward toward the Himalayan foothills. Which rainfall distribution is most commonly associated with this configuration?

A) Enhanced rainfall over central India and complete suppression over the Himalayan foothills
B) Reduced rainfall over much of central India and increased rainfall along the Himalayan foothills
C) Uniformly enhanced rainfall across all of India
D) Complete cessation of rainfall over the Indo-Gangetic plains and peninsular India

Q.48. Data Assimilation

In an idealized scalar data-assimilation problem, background and observation errors are unbiased, independent, and Gaussian. The background-error variance is 16 units^2, and the observation-error variance is 9 units^2. Using the optimal analysis weight for the observation,

$K=\frac{\sigma_b^2}{\sigma_b^2+\sigma_o^2},$

what is the observation weight?

A) 0.36
B) 0.44

C) 0.64

D) 0.80

Q.49. Meteorological Instrumentation

A tipping-bucket rain gauge has a calibration of 0.2 mm per tip. During a 15-minute interval, it records 180 tips. Assuming no missed tips or calibration errors, what is the average rainfall intensity?

A) 72 mm h^{-1}

B) 120 mm h^{-1}

C) 144 mm h^{-1}

D) 216 mm h^{-1}

Q.50. Forecast Verification

A probabilistic forecast system issues a 70% probability of rainfall for 100 independent cases. Rainfall occurs in 60 cases. Which conclusion is most defensible from this information alone?

A) The forecast system is perfectly reliable at all probability levels.

B) The 70% forecasts show a sample frequency of 60%, suggesting overforecasting at that probability level in this sample.

C) The system has zero Brier score because rainfall occurred in most cases.

D) The system has no forecast bias because 60 events occurred.

ANSWER KEY

Question No.	Answer	Question No.	Answer
1	C	**26**	B
2	D	**27**	C
3	B	**28**	D
4	C	**29**	A
5	A	**30**	B
6	B	**31**	C
7	D	**32**	D
8	B	**33**	A
9	C	**34**	B
10	A	**35**	C
11	D	**36**	D
12	B	**37**	A
13	**C / D***	**38**	B
14	C	**39**	C
15	A	**40**	D
16	B	**41**	A
17	D	**42**	D
18	B	**43**	B

19	A	**44**	D
20	C	**45**	C
21	B	**46**	C
22	D	**47**	B
23	C	**48**	C
24	D	**49**	C
25	A	**50**	B

CLARIFICATION

* Question No. 13 contains duplicate options: both options C and D state the same value (approximately 7.29×10^{-5} s^{-1}). Both options are therefore mathematically equivalent based on the question as supplied. The treatment of this item should be confirmed by the competent examination authority before publication of the final answer key.

Note: This is a preliminary answer key prepared from the question paper provided. It does not constitute a final determination. Any subsequent correction or clarification issued by the competent authority shall take precedence.

Examination Coordination Section
Technical Assistant – Technical Examination 2026