Section A (4 × 1 = 4)

1. **Which type of lens has a positive power?**

   Answer: (b) Convex lens
   Explanation: Power of a lens $P = 1/f$. Convex lens has positive focal length (converging), so positive power. Concave lens has negative focal length (diverging), so negative power.

2. **Assertion-Reason**
   Answer: (a) Both assertion and reason are true, and reason is the correct explanation of assertion.
   Explanation: White light disperses in a prism because different wavelengths (colours) deviate by different amounts due to varying speeds in the medium ($v = c/\mu$, μ differs for colours).

3. **Magnetic poles in solenoid**
   Answer: (b) ii and iv
   Explanation: Polarity depends on direction of current (right-hand grip rule). Reversing current reverses polarity (ii correct). Opposite poles form at ends (one N, one S → iv correct). i and iii are wrong as both ends can't be same pole.

4. **Matching – Step-up transformer**
   Answer: (c) A-3-iii, B-1-ii, C-2-i Explanation:

   o   Primary coil: Input (3), thick wire (iii – low current, high voltage side in step-up).

   o   Secondary coil: Output (1), thin wire (ii – high current, low voltage? Wait – actually in step-up: secondary has more turns → thin wire).

   o   Core: Confines flux (2), soft iron (i). Correct matching as per standard.

Section B (7 × 2 = 14)

5. **Wave speed**
   Answer: 8 m/s
   Calculation: Distance between consecutive particles in same phase = λ = 4 m. Time for 10 vibrations = 5 s $\Rightarrow$ f = 10/5 = 2 Hz. $v = f\lambda = 2 \times 4 = 8$ m/s.

6. **Tuning fork and string**
   Answer: Resonance
   Explanation: When frequency of tuning fork matches natural frequency of string, forced vibrations occur with large amplitude due to resonance.

7A. **Tyndall effect Answer: Tyndall effect**
Examples (any two): Path of light visible in dusty room/cinema hall, sunlight through forest canopy, projector beam in smoke, street light in fog. *Explanation*: Scattering of light by colloidal particles makes path visible.

7B. **Colour of Sun**
Answer: Red at sunrise/sunset; whitish at noon.
Explanation: At sunrise/sunset, light travels longer path through atmosphere → more

scattering of shorter wavelengths (blue/violet). Red (longer λ) scatters least → reaches eye. At noon, shorter path → less scattering → appears white.

8. **Magnetic field direction around conductor**
   (a) Negative terminal to P
   (b) Right-hand thumb rule
   Explanation: For anticlockwise field (viewed from above), current must flow upwards in AB. Using right-hand thumb rule, thumb upwards → fingers curl anticlockwise.

9. **Heating effect** *
   Explanation: $H = V^2t/R$ (Joule's law). Voltage V and time t same. Second circuit produces more heat (3600 J > 900 J) ⇒ lower resistance R ⇒ higher current.

10. **Reducing carbon footprint in public transport** **
    Any relevant points (2 marks)*: Use electric/public vehicles, promote carpooling/cycling, renewable energy sources, tree plantation, awareness campaigns, reduce single-use plastics.

11A. **Induced emf**
(a) **Increases** – Faster motion → rapid flux change → higher emf (Faraday's law).
(b) **Zero** – No relative motion → no flux change.

11B. **Electromagnetic induction**
(a) **Electromagnetic induction** – Induced emf due to change in magnetic flux.
(b) **Factors**: Rate of flux change (speed), number of turns, strength of magnetic field.

Section C (6 × 3 = 18)

12A. **Lens formula** u = −20 cm, v = −10 cm (virtual erect image by concave lens). $1/f = 1/v - 1/u = -1/10 - (-1/20) = -1/10 + 1/20 = -1/20$ **f = −20 cm**

12B. **Magnification** Given f = −15 cm, u = −25 cm, v = −10 cm. $m = v/u = (-10)/(-25) = $ **0.4** (erect, diminished)

13. **Vision defect(a) Hypermetropia (long-sightedness)** – Image forms behind retina when object at near point. **(b) Corrected by convex lens(c) Near point farther than 25 cm** (normal near point = 25 cm)

14. **MRI and metals(a)** Strong magnetic field attracts ferromagnetic objects (danger), induces current → heating/burns, distorts image. **(b)** Magnetic shielding with soft iron sheets.

15. **Energy consumption** Total power = 5×60 + 2×80 + 200 = 660 W Daily energy = 660 × 8 / 1000 = 5.28 kWh Monthly (30 days) = 158.4 kWh Cost = 158.4 × 5 = **Rs 792**

16. **Operating voltage** Rated: $R = V^2/P = 240^2/400 = 144\ \Omega$ New P = 100 W ⇒ $V = \sqrt{(P \times R)} = \sqrt{(100 \times 144)} = $ **120 V**

17A. **Generator**
(a) **DC generator** (split ring commutator).
(b) **Split ring commutator and brushes**
(c) **AC** – Rotating magnet reverses flux direction every half turn → alternating current.

17B. **Power stations**
(a) **11 kV**

(b) Nuclear → Heat → Mechanical → Electrical
(c) Fuel burnt → heat → steam → turbine rotation → generator.

Section D (1 × 4 = 4)

18A. **Motor principle**
(a) South pole at X
 (b) Fleming's left-hand rule – Forefinger (field), middle finger (current), thumb (force). **(c) Reverse direction of current**

18B. **Electric motor**
(a) North at Y (when AB moves up)
(b) Diagram of Fleming's left-hand rule arrows.
(c) Reverse current direction (battery polarity)
(d) Electrical → Mechanical energy