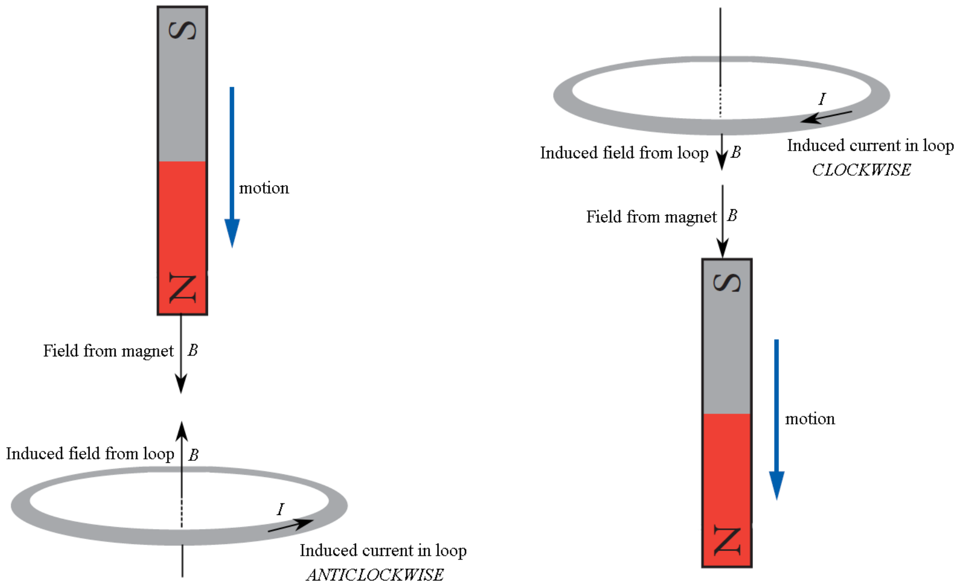
Chapter 8 Electromagnetic induction and radiation. Revision Questions page 237-241 – Multiple Choice Answers

Q	Ans	Explanation
1	D	**As the N-pole approaches:** a N-pole will be induced at the top of the solenoid to repel the incoming magnet (Lenz's law). Think of it as the field from the magnet is pointing down the page, so an induced opposing fields in the loop points up the page. To determine the direction of current you should use Ampere's **right-hand** rule for solenoids: put your thumb in direction of the magnetic field (up the page). Your fingers will curl in an anti-clockwise (**counter-clockwise**) direction around the loop.  **As the top of the magnet (S-pole) departs the bottom of the solenoid: :** a N-pole will be induced at the bottom of the solenoid to attract the S-pole of the departing magnet (Lenz's law). That is, the induced field will also point down. To determine the direction of current you should use Ampere's right hand rule for solenoids: put your thumb in direction of the magnetic field (down the page as below the bottom loop of the solenoid is North, the field points away from the North which is downwards). Your fingers will curl in a **clockwise** direction around the bottom loop. Whew, that's a lot for 1 mark.
2	B	When the switch is closed current travels clockwise through coil A. This produces a field into the page (using your Right Hand rule for loops and solenoids, page 193). The production of this new field induces a magnetic field in Coil B in the opposite direction (out of the page). So, you must have an **anti-clockwise** current in Coil B to produce it (using your RH rule).
3	B	A True. For a step-up, the voltage gets bigger so the current gets smaller. **B False. Step-up means a step-up (bigger) voltage in the secondary.** C True. The rate of change of flux (the frequency) doesn't change. D True. There is loss of power in a non-ideal transformer.

4	D	This is the description of an EM wave and should be learnt.
5	A	Flux density is the amount of magnetic flux (in Wb) per square metre (m^2). Wb/m^2 is $Wb\ m^{-2}$.
6	A	$EMF = \frac{\Delta BA\cos\theta}{\Delta t} = \frac{\Delta B}{\Delta t} \times A\cos\theta$ $= RA\cos\theta\ (as\ R = \frac{\Delta B}{\Delta t})$ Note: be careful that the angle θ is the angle between the field and the perpendicular to the plane of the loop. This is a big trap for the unwary. See page 212.
7	D	The power loss is proportional to the current so the smaller the current the small the power loss (see page 226). To get small current you need high voltage. Thus: step up to the very high voltage of 33kV (or 11kV, or whatever) which will give a low current, and then stepdown to 415V at factory.
8	C	I is wrong as you can't get more power out than you put in; II "The magnetic flux produced by the primary entirely links the secondary." This is true for an ideal transformer (see page 228). As an aside, you will always lose some power in a transformer as heat mainly so it is difficult to have an 'ideal' one. III has nothing to do with an ideal transformer – it is about whether it is step-up or step-down.
9	D	The power output (P_S) equals the power input (P_P) for an ideal transformer: $P_S = P_P$
10	A	Speed of emr in a vacuum is 3×10^8 m s^{-1}. It is not dependent on the frequency. If it was, you'd see the colours separate out in light from a torch because some colours would have different speeds to others.