Transformations & Transmission of Electrical Energy

Mark Scheme 1

Level	International A Level
Subject	Physics
Exam Board	CIE
Topic	Alternating Currents
Sub Topic	Transformers & Transmission of Electrical Energy
Paper Type	Theory
Booklet	Mark Scheme 1

Time Allowed: **53 minutes**

Score: **/44**

Percentage: **/100**

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 **(a** can change (output) voltage efficiently *or* to suit different consumers/appliances B1
by using transformers B1 [2]

(b) for same power, current is smaller B1

less heating in cables/wires
or thinner cables possible
or less voltage loss in cables B1 [2]

2 **(a)** moving magnet gives rise to/causes/induces e.m.f./current in solenoid/coil B1
(induced current) creates field/flux in solenoid that opposes (motion of) magnet B1
work is done/energy is needed to move magnet (into solenoid) B1
(induced) current gives heating effect (in resistor) which comes from the work done B1 [4]

(b) current in primary coil give rise to (magnetic) flux/field B1
(magnetic) flux / field (in core) is in phase with current (in primary coil) B1
(magnetic) flux threads/links/cuts secondary coil inducing e.m.f. in secondary coil B1
*(there **must** be a mention of secondary coil)*
e.m.f. induced proportional to <u>rate</u> of change/cutting of flux/field so not in phase B1 [4]

3 **(a** **(i)** to reduce power loss in the core B1
due to eddy currents/induced currents B1 [2]

(ii) *either* no power loss in transformer
or input power = output power B1 [1]

(b) *either* r.m.s. voltage across load = $9.0 \times (8100 / 300)$ C1
peak voltage across load = $\sqrt{2} \times 243$
= 340 V A1 [2]
or peak voltage across primary coil = $9.0 \times \sqrt{2}$ (C1)
peak voltage across load = $12.7 \times (8100/300)$
= 340 V (A1)

4 **(a** induced e.m.f./current produces effects / acts in such a direction / tends to oppose the change causing it A1 [2]

(b) (i) **1.** to reduce flux losses / increase flux linkage / easily magnetised and demagnetised [1]

2. to reduce energy / heat losses (*do not allow 'to prevent energy losses'*) M
caused by eddy currents A1 [2]
(*allow 1 mark for 'reduce eddy currents'*)

(ii) alternating current / voltage B1
gives rise to (changing) flux in core B1
flux links the secondary coil M1
(by Faraday's law) changing flux induces e.m.f. (in secondary coil) A1 [4]

5 **(a) (i)** to concentrate the (magnetic) flux / reduce flux losses B1 [1]

(ii) changing flux (in core) induces current in core M1
currents in core give rise to a heating effect A1 [2]

(b) (i) e.m.f. induced proportional to M1
rate of change of (magnetic) flux (linkage) A1 [2]

(ii) magnetic flux in phase with / proportional to e.m.f. / current in primary coil M1
e.m.f. / p.d. across secondary proportional to rate of change of flux M1
so e.m.f. of supply not in phase with p.d. across secondary A0 [2]

(c) (i) for same power (transmission), high voltage with low current B1
with low current, less energy losses in transmission cables B1 [2]

(ii) voltage is easily / efficiently changed B1 [1]

6	**(a)**	**(i)**	e.g. prevent flux losses / improve flux linkage	B1	[1]
		(ii)	flux in core is changing	B1	
			e.m.f. / current (induced) <u>in core</u>	B1	
			induced current in core causes heating	B1	[3]
	(b)	**(i)**	that value of the direct current producing same (mean) power / heating in a resistor	M1 A1	[2]
		(ii)	power in primary = power in secondary	M1	
			$V_P I_P = V_S I_S$	A1	[2]