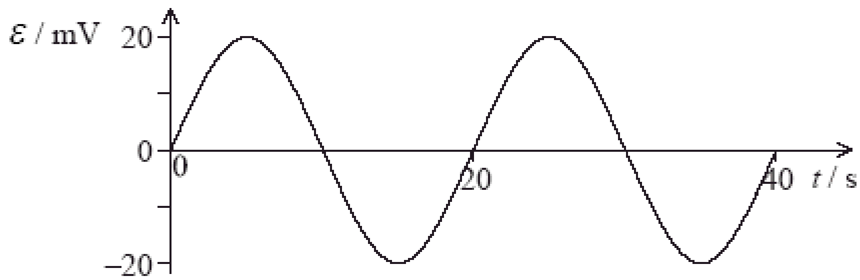
IB PHYSICS
Name: ___________________________________
Period: ________ Date: ___________________
Marks: **70** Raw Score: ____ IB Curve: ____

DEVIL PHYSICS

BADDEST CLASS ON CAMPUS

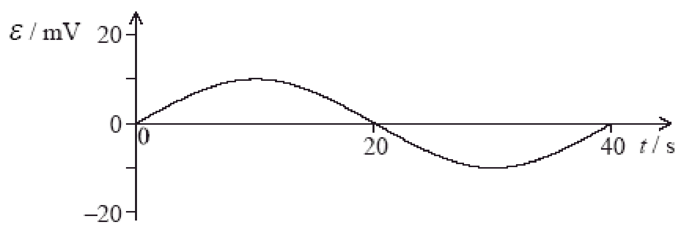
CHAPTER 11 TEST REVIEW

1. The graph shows the variation of the induced emf ε of a generator as a function of time.

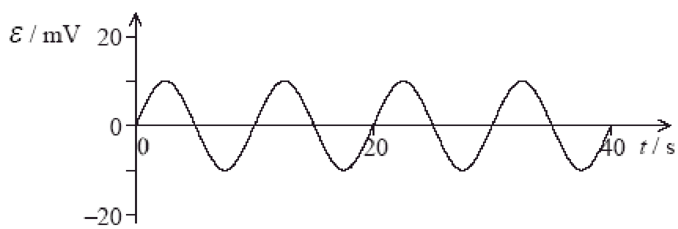


The frequency of rotation of the generator is halved. Which of the following graphs correctly shows the variation of the new induced emf ε as a function of time?

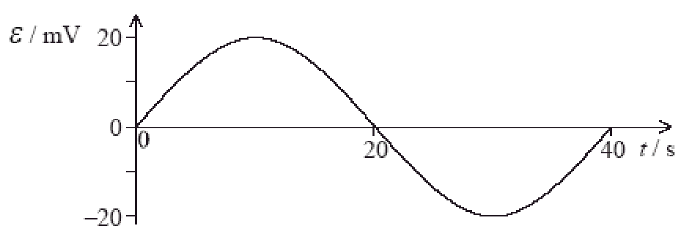
A.



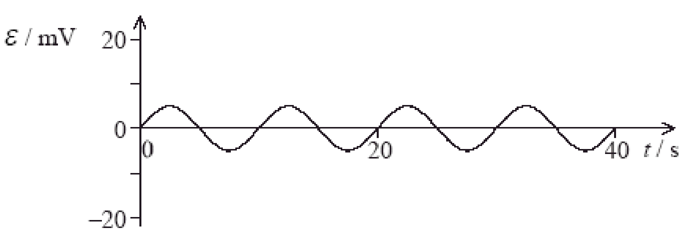
B.



C.



D.



(Total 1 mark)

2. A magnetic flux linking a wire loop changes sinusoidally with time. The emf induced in the loop changes sinusoidally

A. in phase with the changing flux.

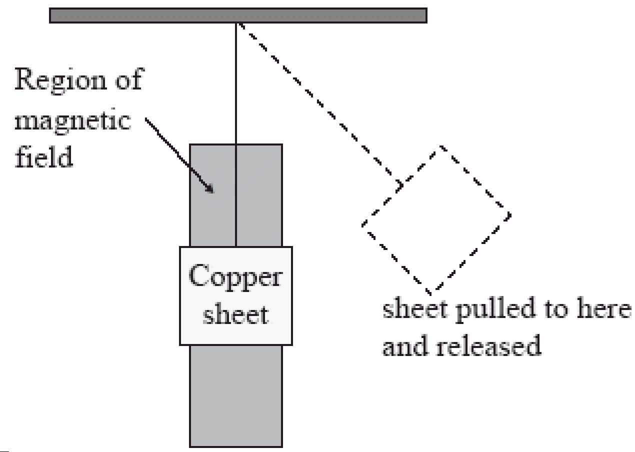
B. out of phase with the changing flux by a quarter period.

C. out of phase with the changing flux by a third of a period.

D. out of phase with the changing flux by half a period.

(Total 1 mark)

3. A copper sheet is suspended in a region of uniform magnetic field by an insulating wire connected to a horizontal support. The sheet is pulled to one side so that it is outside the region of the field, and then released.



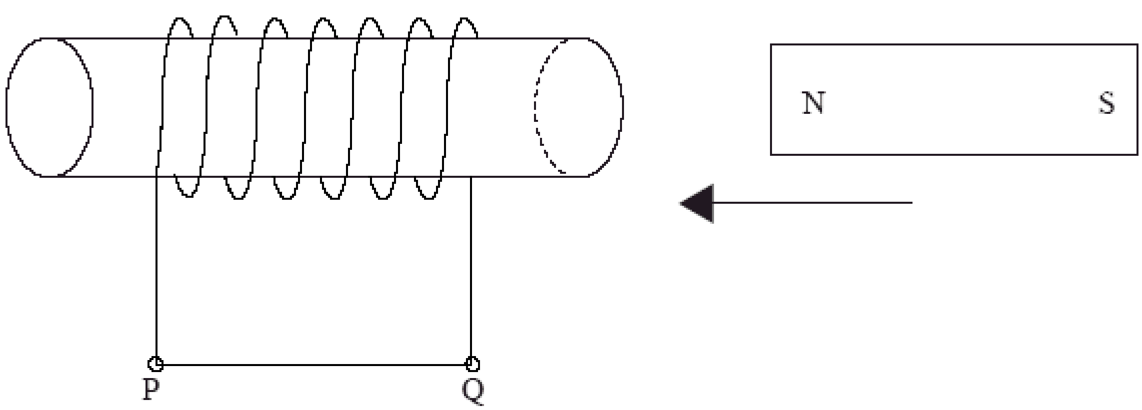
The uniform magnetic field is directed into the plane of the paper.

Which of the following is true for both the direction of the induced current in the sheet and the change in amplitude of the oscillations of the sheet with time?

	Direction of induced current	Change in amplitude
A.	stays the same	no change
B.	changes	decreases
C.	stays the same	decreases
D.	changes	no change

(Total 1 mark)

4. A permanent bar magnet is moved towards a coil of conducting wire wrapped around a non-conducting cylinder. The ends of the coil, P and Q are joined by a straight piece of wire.



The induced current in the **straight piece of wire** is

A. alternating.

B. zero.

C. from P to Q.

D. from Q to P.

(Total 1 mark)

5. The rms current rating of an electric heater is 4 A. What direct current would produce the same power dissipation in the electric heater?

A. $\frac{4}{\sqrt{2}}$ A

B. 4 A

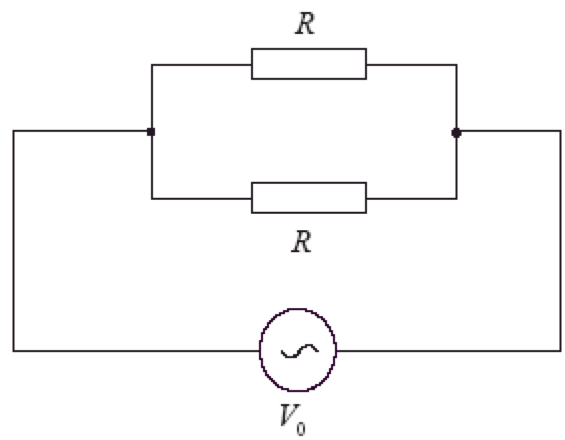
C. $4\sqrt{2}$A

D. 8 A

(Total 1 mark)

6. An alternating current supply of negligible internal resistance is connected to two resistors that are in parallel.

The resistance of each resistor is R and the peak voltage of the ac supply is V_0. Which of the following is the average power dissipated in the circuit?



A. $\frac{2V_0^{\ 2}}{R}$

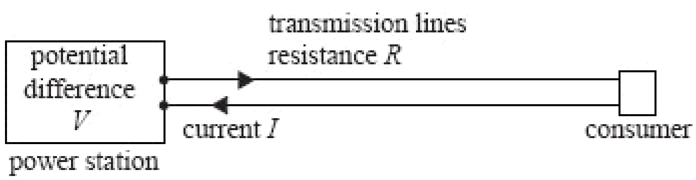
B. $\frac{V_0^{\ 2}}{R}$

C. $\frac{V_0^{\ 2}}{\sqrt{2}R}$

D. $\frac{V_0^{\ 2}}{2R}$

(Total 1 mark)

7. A power station generates electrical energy at a potential difference V and current I. The resistance of the transmission lines between the power station and the consumer is R.



The power lost in the transmission lines is

A. 0.

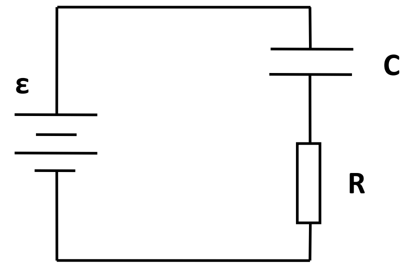
B. $\frac{V^2}{R}$.

C. RI^2.

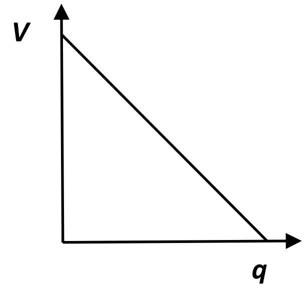
D. VI.

(Total 1 mark)

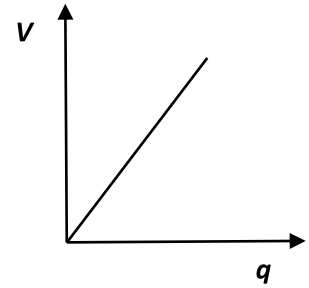
8. In the circuit shown a capacitor that is initially uncharged is being charged by a battery.



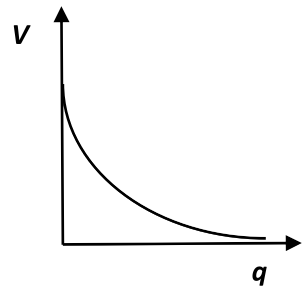
Which of the following is a correct graph of the variation of the potential difference *V* across the plates with the charge *q* on one of the capacitor plates?



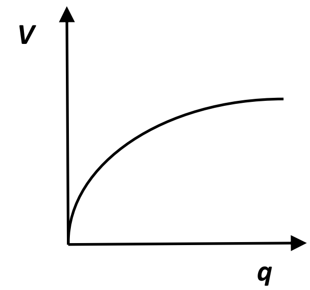
A.



B.

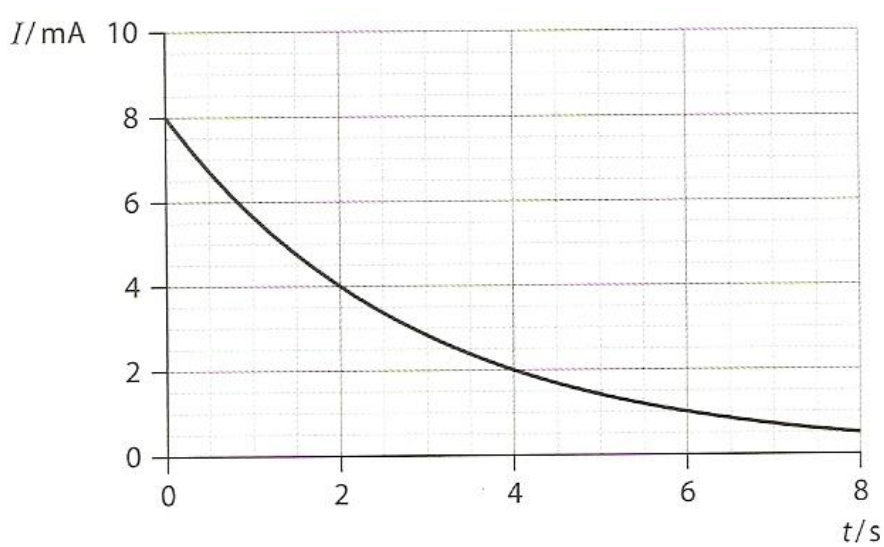


C.



D.

9. The graph shows the variation with time t of the current I for a discharging capacitor.



What is the time constant of this system?

A. $2.0 s$

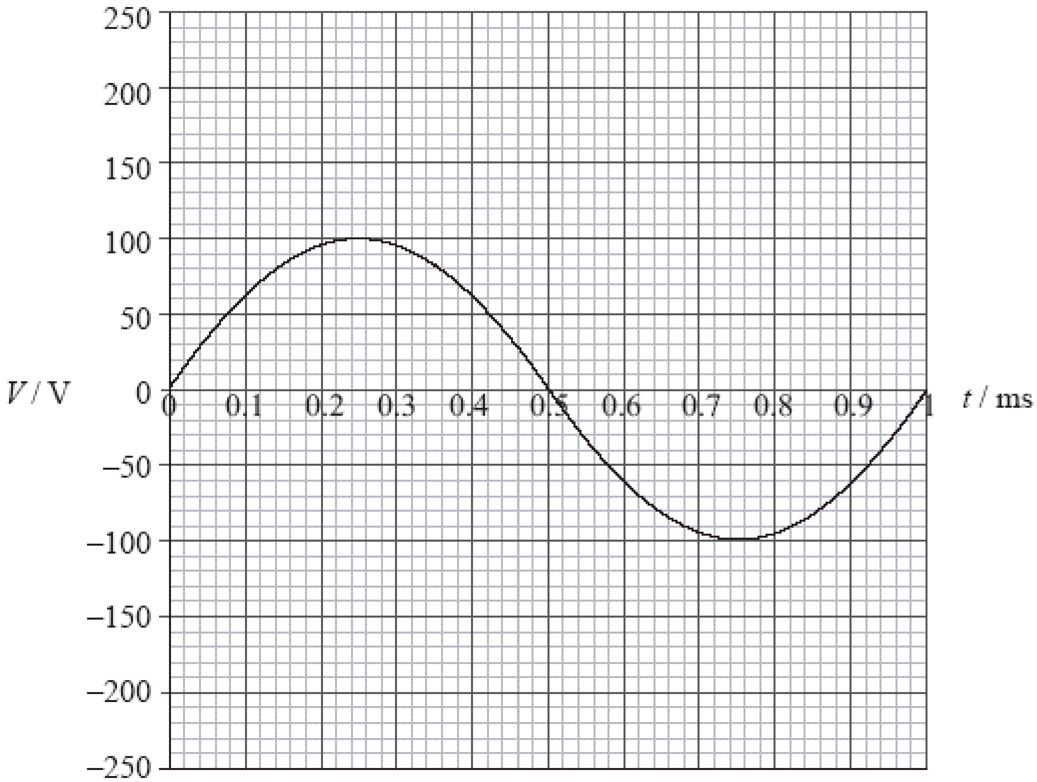
B. $2.0\sqrt{2} s$

C. $\frac{2.0}{\sqrt{2}} s$

D. $\frac{2.0}{\ln 2} s$

10. This question is about alternating current.

(a) The graph shows the variation with time *t* of the output voltage *V* of an ac generator of negligible internal resistance.



A resistor of resistance 25 Ω is connected across the output of the generator.

Calculate

(i) the rms value of the current in the resistor.

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(2)

(ii) the average power dissipated in the resistor.

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(1)

(iii) the power dissipated in the resistor at 0.40 ms.

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(2)

(b) The frequency of rotation of the generator coil is now doubled. Sketch, using the axes in (a), the variation with *t* of the new output voltage *V*.

(2)

11. This question is about the emf induced in a coil.

(a) Define *magnetic flux*.

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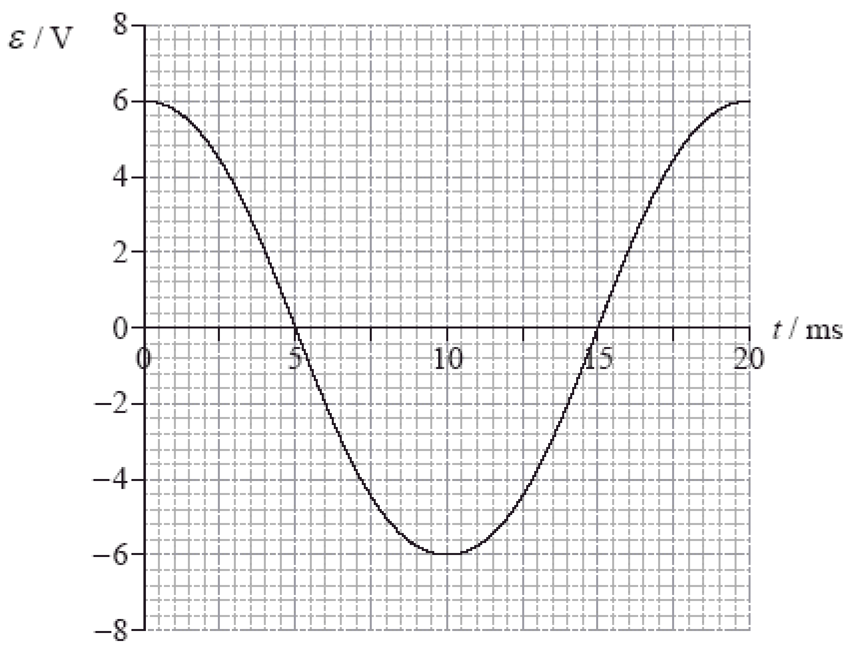
(2)

(b) A coil is rotated at constant speed in a region of uniform magnetic field.

The graph shows the variation with time *t* of the emf ε induced in the coil for one cycle of rotation.



(i) On the graph label, with the letter T, a time at which the flux linkage in the coil is a maximum.

(1)

(ii) Use the graph to determine the rate of change of flux at $t = 4.0$ ms. Explain your answer.

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(2)

(iii) Calculate the root mean square value of the induced emf.

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(1)

12. This question is about induced emf and transformers.

(a) One of the coils of a particular transformer is connected in series with a switch and a battery. The coil has low resistance. On closing the switch it is observed that the current takes a certain amount of time to reach its final constant value. Explain this observation with reference to Faraday's law and Lenz's law.

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(3)

(b) In a particular power station the voltage generated is stepped up by a transformer. The root mean square voltage is increased by a factor of 2×10^3. The output power of the transformer is transmitted to a town by cables.

(i) Outline what is meant by the root mean square value of a time-varying voltage.

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(2)

(ii) State the best estimate for the factor by which the power loss in the cables is reduced as a result of stepping up the voltage.

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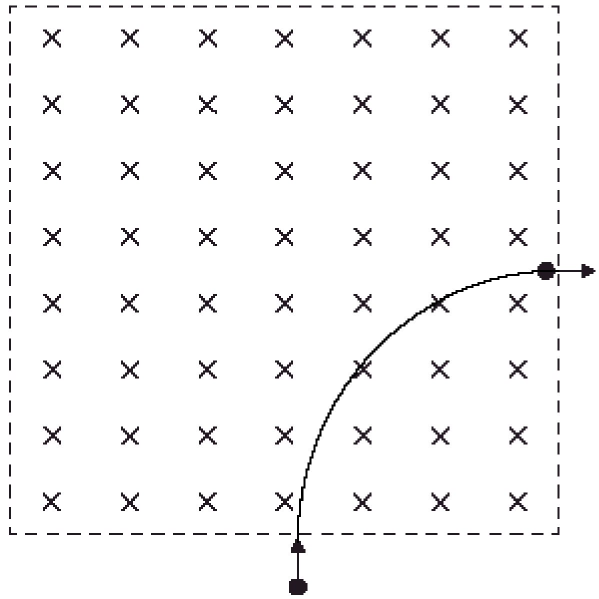
(1)

13. This question is about motion in a magnetic field and electromagnetic induction. An electron, that has been accelerated from rest by a potential difference of 250 V, enters a region of magnetic field of strength 0.12 T that is directed into the plane of the page.



(a) The electron's path while in the region of magnetic field is a quarter circle. Show that the

(i) speed of the electron after acceleration is 9.4×10^{6} m s^{-1}.

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(2)

(ii) radius of the path is 4.5×10^{-4} m.

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(2)

(iii) time the electron spends in the region of magnetic field is 7.5×10^{-11} s.

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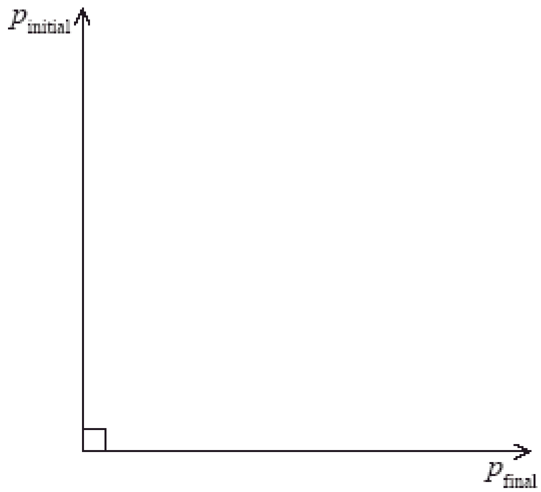
(1)

(b) The diagram below shows the momentum of the electron as it enters and leaves the region of magnetic field. The magnitude of the initial momentum and of the final momentum is 8.6×10^{-24} Ns.



(i) On the diagram above, draw an arrow to indicate the vector representing the change in the momentum of the electron.

(1)

(ii) Show that the magnitude of the change in the momentum of the electron is 1.2×10^{-23} Ns.

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(1)

(iii) Estimate the magnitude of the average force on the electron.

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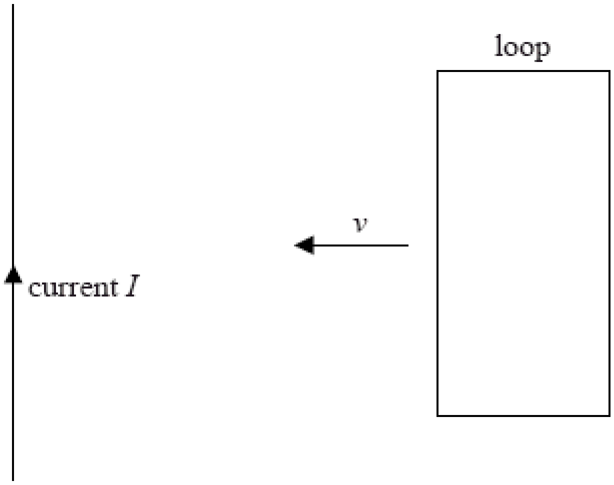
(1)

(c) A square loop of conducting wire is placed near a straight wire carrying a constant current *I*. The wire is in the same plane as the loop.



The loop is made to move with constant speed *v* towards the wire.

(i) Explain, by reference to Faraday's and Lenz's laws of electromagnetic induction, why work must be done on the loop.

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(3)

(ii) Suggest what becomes of the work done on the loop.

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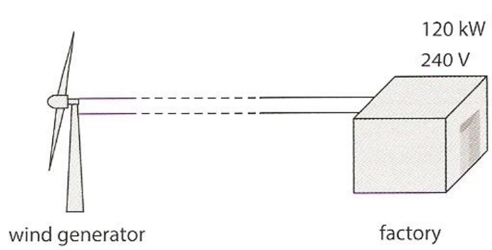
(1)

14. A wind generator provides power to a factory whose equipment operates at 120 kW and 240 V. The factory is connected to a wind generator with cables of total resistance of 0.80 Ω.



(a) Calculate

(i) the power lost in the cables

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(2)

(ii) the voltage at the wind generator

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(2)

(iii) the efficiency of the transmission system

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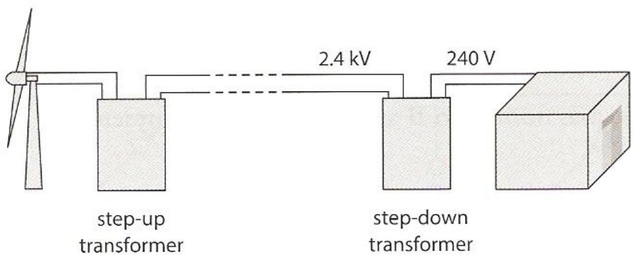
(1)

(b) It is suggested that a transformer be used to step up the voltage of the wind generator so that the step-down transformer near the factory would bring the voltage down from 2.4 kV to 240 V.



Determine the power lost in the cables now

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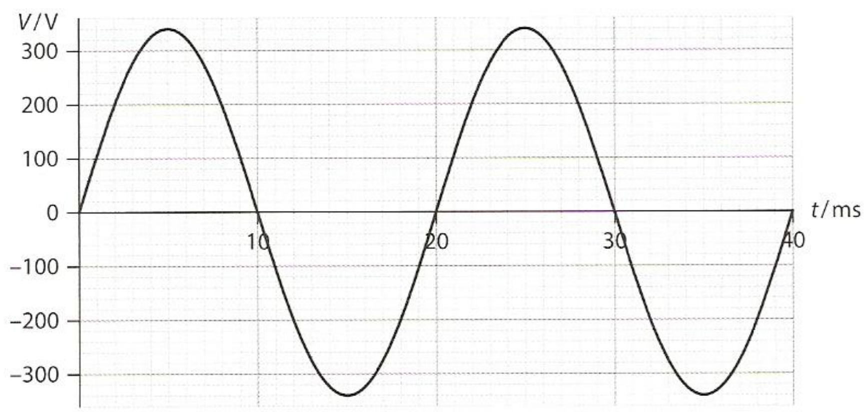
(2)

(c) The graph shows the variation with time of the voltage in a particular piece of machinery in the factory.



(i) Show that the rms value of the voltage is 240 V.

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(1)

(ii) The average power dissipated in this machinery is 18 kW. Calculate the peak current in the machinery.

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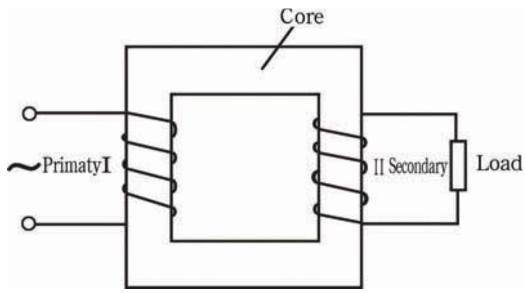
(2)

(d) The diagram shows a simple transformer. The core is made of iron.



(i) Explain how an ac voltage in the primary coil gives rise to an ac voltage in the secondary coil.

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(4)

(i) Explain why the core gets warm while the transformer is operating.

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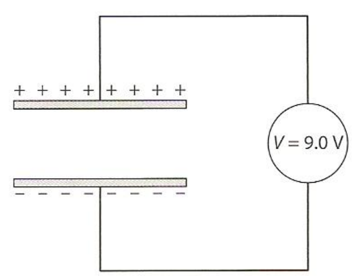
(2)

14. The diagram shows a charged parallel plate capacitor in a vacuum connected to an ideal voltmeter. The reading on the voltmeter is 9.0 V



(a) Explain why the capacitor does not discharge.

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(2)

(b) The plates are 4.4 mm apart and have an area of 0.68 m^2

(i) Calculate the capacitance of the capacitor

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(2)

(ii) Determine the charge on one of the parallel plates of the capacitor

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(2)

(iii) Calculate the energy stored in the electric field in between the plates

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(2)

(b) A dielectric of electric permittivity $\varepsilon = 12\varepsilon_0$ is inserted between the parallel plates of the capacitor. State and explain the effects of this, if any, on:

(i) the charge on one of the plates

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(1)

(i) the charge on one of the plates

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(3)

(i) the charge on one of the plates

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(2)