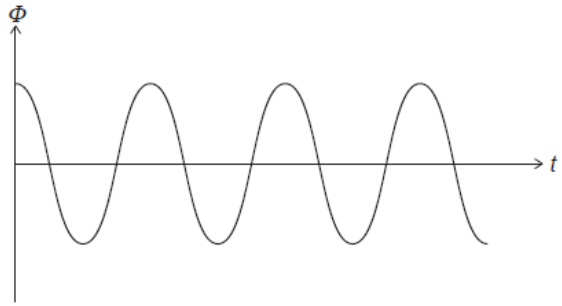
Homework — Part 2: Exam practice (IB past papers)

10 real IB questions: Paper 1A (multiple choice) and Paper 2, mixed. Total: **23 marks**. Use the data booklet. For Paper 1A, write the letter and a short reason. In Paper 2, some parts of the original question are left out.

Useful: $\varepsilon = BvL$, $\varepsilon = -N\frac{\Delta\Phi}{\Delta t}$, $F = BIL$, $\omega = 2\pi f$. Scoring words: *rate of change of flux linkage*, *opposes the change*.

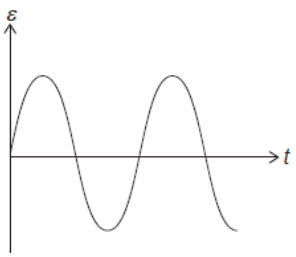
1. Paper 1A IB May 2022

The graph shows the variation of magnetic flux Φ in a coil with time t.

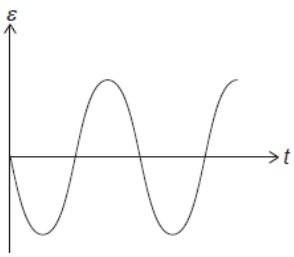


What represents the variation with time of the induced emf ε across the coil?

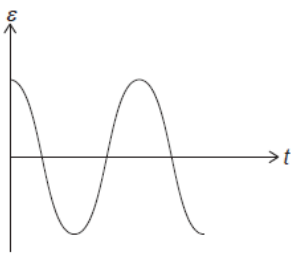
A.



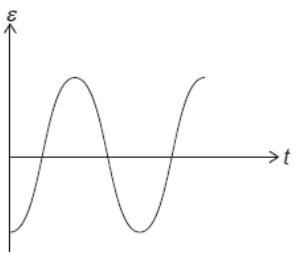
B.



C.



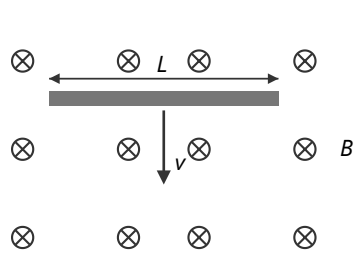
D.



[1]

2. Paper 2 IB May 2024 (parts of one question)

A conducting rod of length L is moved with speed v at right angles to a uniform magnetic field of flux density B. The field is directed into the plane of the page.



(a) **Show**, using Faraday's law or otherwise, that the potential difference, V, established between the ends of the rod is $V = vBL$. [3]

(b) **Identify** the end of the rod that becomes negatively charged. [1]

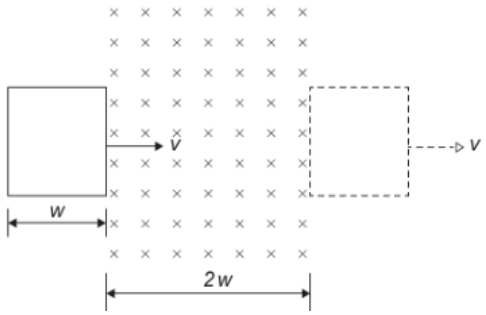
A coil is rotating in a region of magnetic field with angular speed 12.56 rad s^{-1}. At $t = 0$, the field is parallel to the surface of the coil.

(c) **State** the magnetic flux linkage through the coil at $t = 0$. [1]

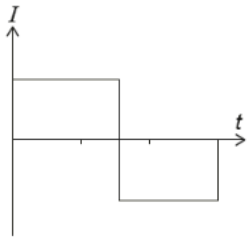
(d) **Draw** a graph to show the variation with time of the induced emf in the loop, from $t = 0$ to $t = 1.0$ s. (No numbers are required on the vertical axis.) [2]

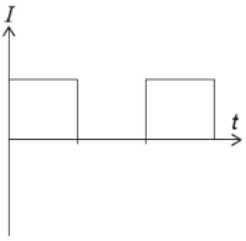
3. Paper 1A IB May 2024

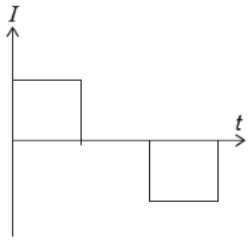
A square loop of wire of width w is pulled at a constant velocity v through a magnetic field of width $2w$.

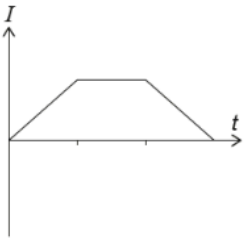


Which of the following shows the variation of current I in the loop with time t?

A.


B.


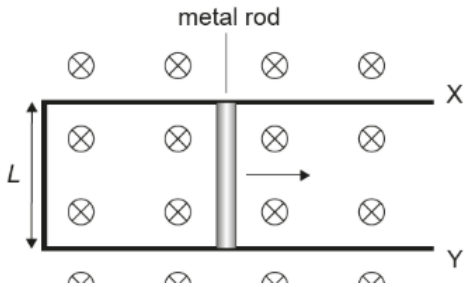
C.


D.


[1]

4. Paper 2 IB November 2025 (parts of one question)

A metal rod is pulled along two horizontal conducting rails X and Y so that it rolls to the right at a constant speed. The two rails are connected by a straight conducting wire of length $L = 0.60$ m. The system is in a region of uniform magnetic field of magnitude $B = 1.2$ T directed into the page.



As a result of the motion, the metal rod experiences a magnetic force of 0.084 N.

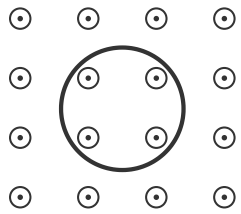
(a) **Show that** the current in the metal rod is about 0.1 A. [1]

(b) **State** the direction of the magnetic force on an electron in the metal rod. [1]

(c) **Outline** how Lenz's law applies to this system. [2]

5. Paper 1A IB November 2025

A conducting ring is perpendicular to a uniform magnetic field directed out of the page.



The magnitude of the magnetic field strength increases. What are the direction of the conventional current induced in the ring and the net magnetic force on the ring?

	Current induced in the ring	**Magnetic force on the ring**
A.	clockwise	zero
B.	counter-clockwise	zero
C.	clockwise	non-zero
D.	counter-clockwise	non-zero

[1]

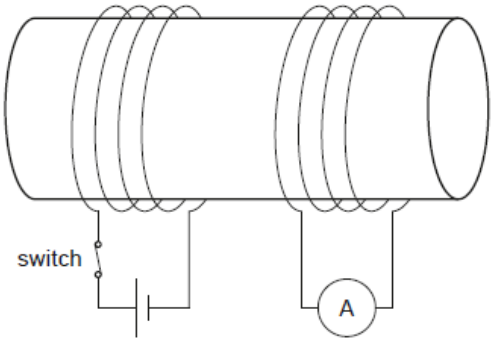
6. Paper 2 IB May 2026 (one part)

An electric generator consists of a rectangular coil rotating in a uniform magnetic field.

State the angle between the normal to the plane of the coil and the magnetic field vector at which the instantaneous emf induced in the coil is greatest. **[1]**

7. Paper 1A IB November 2022

Two coils of wire are wound around an iron cylinder. One coil is connected in a circuit with a cell and a switch that is initially closed. The other coil is connected to an ammeter. The switch is opened at time t_0.



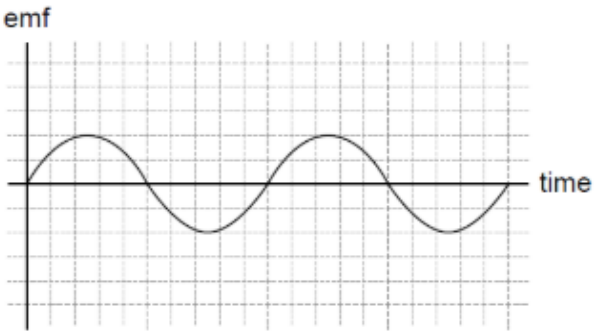
What is the ammeter reading before t_0 and what is the ammeter reading after t_0?

	Ammeter reading before t_0	**Ammeter reading after t_0**
A.	zero	a peak of current falling to zero
B.	zero	zero
C.	non-zero	a peak of current falling to zero
D.	non-zero	zero

[1]

8. Paper 2 IB May 2025 (one part)

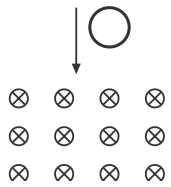
A small coil is made to rotate in a magnetic field so that an emf is induced. The graph shows the variation with time of the emf induced in the coil.



The frequency of rotation is doubled. **Draw** on the graph (copy it into your notebook) the variation with time of the new emf induced. **[2]**

9. Paper 1A IB November 2023

A conducting ring is dropped from rest from above the ground. As it falls the ring passes through a region of uniform horizontal magnetic field. Air resistance is negligible.



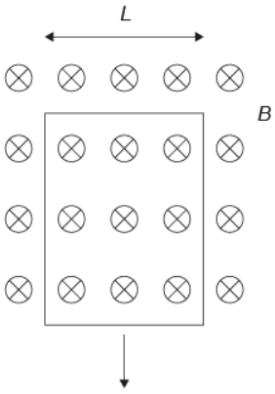
Which is correct about the acceleration a of the ring as it enters and as it leaves the region of magnetic field?

	Ring enters	**Ring leaves**
A.	$a > g$	$a > g$
B.	$a > g$	$a < g$
C.	$a < g$	$a > g$
D.	$a < g$	$a < g$

[1]

10. Paper 2 IB May 2023 (one part)

A vertical rectangular loop of conducting wire is dropped in a region of horizontal magnetic field. The diagram shows the loop as it leaves the region of the magnetic field.



Just before the loop is about to completely exit the region of magnetic field, the loop moves with constant terminal speed v. The following data is available:

Mass of loop	$m = 4.0$ g
Resistance of loop	$R = 25\ \text{m}\Omega$
Width of loop	$L = 15$ cm
Magnetic flux density	$B = 0.80$ T

Determine, in m s^{-1}, the terminal speed v. **[4]**

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