

# GAN ENG SENG SCHOOL

## Preliminary Examination 2026



CANDIDATE  
NAME

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CLASS

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INDEX  
NUMBER

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## PHYSICS

Paper 1 Multiple Choice

6091/01

14 September 2026

1 hour

## Sec 4 Express

Additional Materials: OTAS

### READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name, class and index number on the OTAS in the spaces provided unless this has been done for you.

There are **forty** questions in this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C**, and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate OTAS.

**Read the instructions on the OTAS very carefully.**

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

The use of an approved scientific calculator is expected, where appropriate.

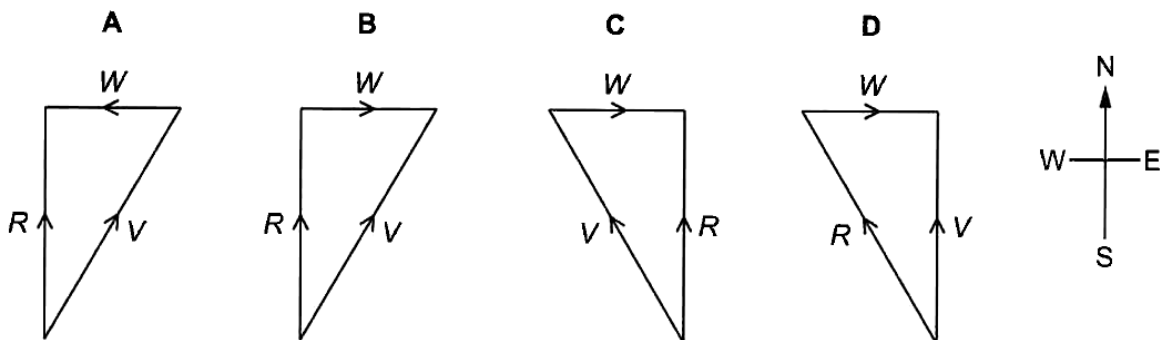
| Total Marks |
|-------------|
| 40          |

- 1 Which expression contains only SI base units?

**A**  $\text{kg m}^2 \text{s}^{-3} \text{A}^{-1}$     **B**  $\text{kg m}^2 \text{s}^{-2} \text{C}^{-1}$     **C**  $\text{J A}^{-1} \text{s}^{-1}$     **D**  $\text{N m A}^{-1} \text{s}^{-1}$

- 2 A boat crosses a river and arrives at a point due north of its starting point. The boat has a speed of  $V$  in still water. A wind is blowing from east to west causing the boat to move with a speed of  $W$  in the same direction.

Which diagram represents the resultant velocity  $R$  of the boat?

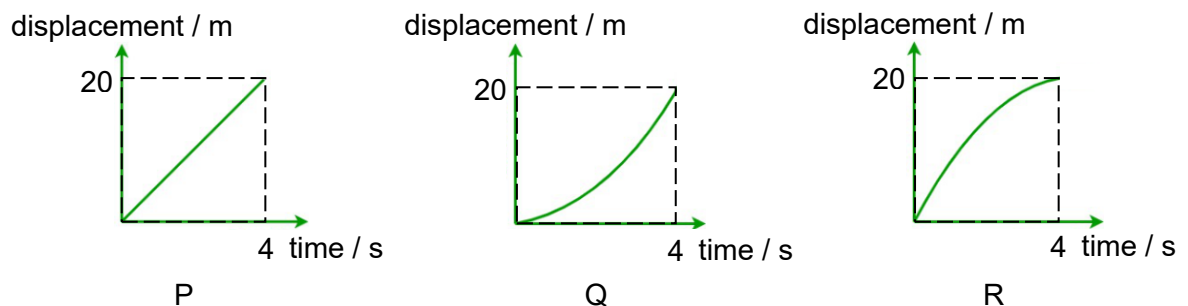


- 3 A stationary object moves a distance  $s$  with a uniform acceleration  $a$ .

What is the time taken for it to move the distance  $s$ ?

**A**  $(s/a)^{1/2}$     **B**  $(2s/a)^{1/2}$     **C**  $s/2a$     **D**  $s/a$

- 4 The diagram shows three displacement-time graphs, P, Q and R.

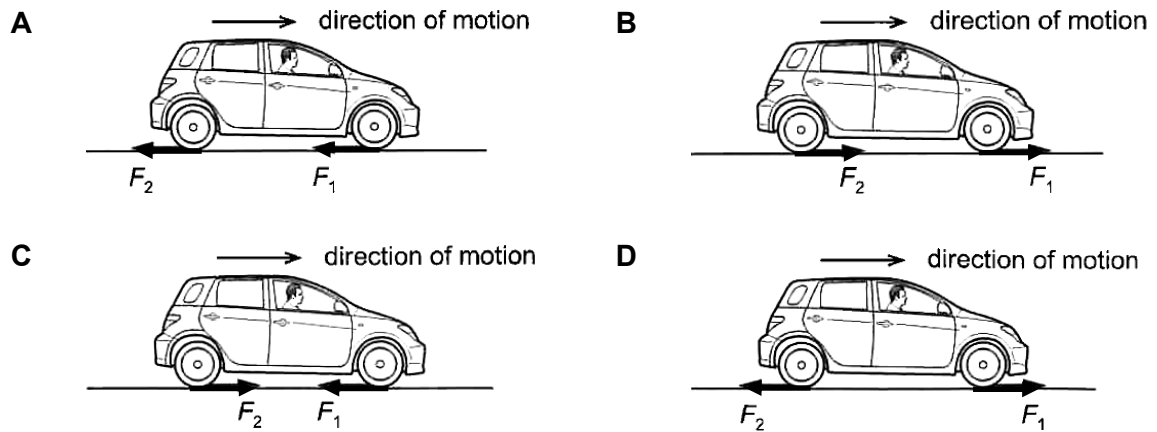


Which statement is correct?

- A** Graph P has the highest instantaneous velocity.  
**B** Graph Q has the highest average velocity.  
**C** Graph R has the highest average velocity.  
**D** All three graphs have the same average velocity.

- 5 A car is accelerating along a level road. **Only** the front wheels of the car are driven by the engine.

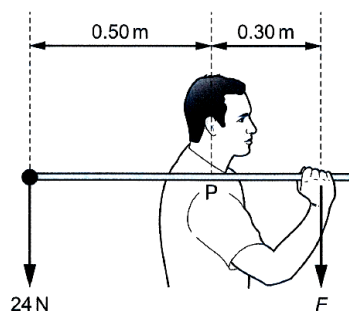
Which diagram shows the direction of frictional force  $F_1$  on the front wheels and the direction of frictional force  $F_2$  on the rear wheels?



- 6 An object of weight  $W$  moves to the left on a smooth horizontal surface at steady velocity. A horizontal force,  $F_1$ , acts on the object to the left and a horizontal force,  $F_2$ , acts on it to the right.

Which statement is correct?

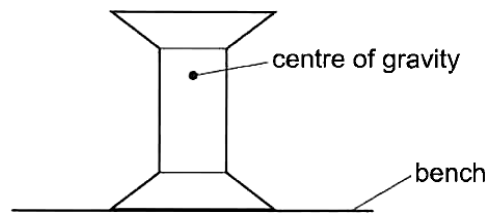
- A  $F_1 > F_2$
- B  $F_1 + F_2 = W$
- C  $F_1 = F_2$  and is an action-reaction pair.
- D  $F_1 = F_2$  but is not an action-reaction pair.
- 7 Matthew is carrying a load on the end of a light stick. He rests the stick on his shoulder at point  $P$ , which acts as a pivot. He keeps the stick in balance by exerting a downward force  $F$  with his hand as shown.



What upward force does his shoulder exert on the stick?

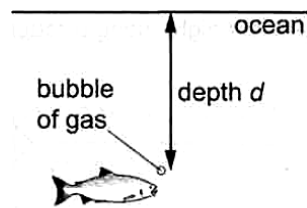
- A 16 N                      B 24 N                      C 40 N                      D 64 N

- 8 The diagram shows the shape of a solid object with its centre of gravity marked.

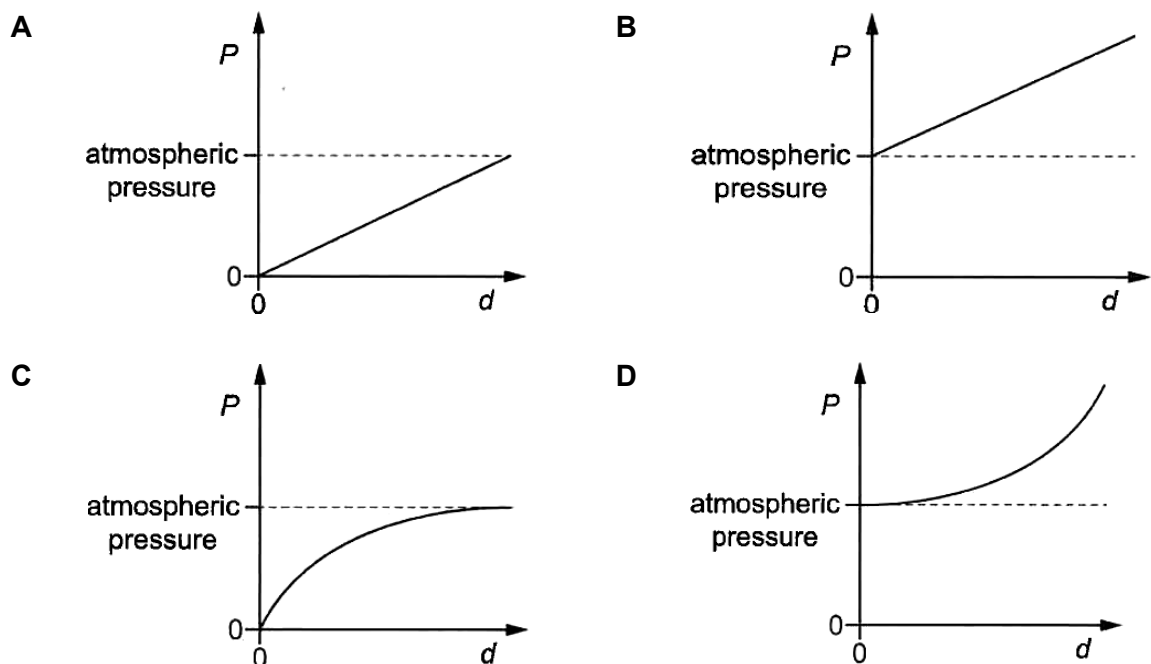


Which action makes the object less stable?

- A Add an extra weight on its top surface.
  - B Make the object from a less dense material.
  - C Move it to a place where the gravitational field is weaker.
  - D Turn it through  $180^\circ$  so that its top surface is now resting on the bench.
- 9 A fish in the ocean releases a bubble of gas. The bubble rises to the surface as shown.



Which diagram shows how the pressure  $P$  of the gas in the bubble varies with its depth  $d$  below the surface of the ocean?



- 10** Two nickel spheres  $M$  and  $N$  are at rest on a frictionless surface. The same force  $F$  acts on  $M$  and on  $N$  for the same time  $t$ . The volume of  $N$  is less than that of  $M$ . Which quantity is the same for both spheres?

**A** density                      **B** energy                      **C** mass                      **D** weight

- 11** A stone enters a deep pool at high speed. It slows down as it moves towards the bottom of the pool.

What is the energy transfer as the stone moves downwards through the water?

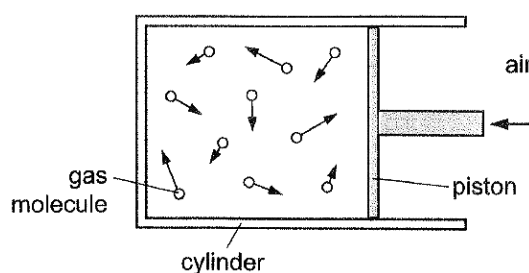
- A** Energy is transferred mechanically from the gravitational potential store to kinetic store and internal store.
- B** Energy is transferred mechanically from the gravitational potential store to kinetic store and by heating from kinetic store to internal store.
- C** Energy is transferred mechanically from gravitational potential store and kinetic store to internal store.
- D** Energy is transferred mechanically from kinetic store to gravitational potential store and internal store.

- 12** A train of mass 40 000 kg is moving along a straight track. The velocity of the train decreases from 30 m/s to 25 m/s.

How much work is done to slow the train down?

**A** 0.1 MJ                      **B** 0.5 MJ                      **C** 5.5 MJ                      **D** 11 MJ

- 13** Gas inside a cylinder is cooled down slowly to a lower temperature and the piston moves inwards.



As the volume decreases, the pressure of the gas remains constant.

What happens to the speed of the gas molecules and their rate of collision with the piston?

|          | speed of molecules | rate of collision |
|----------|--------------------|-------------------|
| <b>A</b> | decreases          | decreases         |
| <b>B</b> | decreases          | increases         |
| <b>C</b> | stays the same     | decreases         |
| <b>D</b> | stays the same     | increases         |

- 14** The water in a swimming pool has a temperature of 28 °C and the hot water in a kettle has a temperature of 80 °C.

Where does the water have the greater total energy in internal store and where do the water molecules have the greater average energy in kinetic store?

|          | greater total energy in internal store | greater average energy in kinetic store |
|----------|----------------------------------------|-----------------------------------------|
| <b>A</b> | in the kettle                          | in the kettle                           |
| <b>B</b> | in the kettle                          | in the pool                             |
| <b>C</b> | in the pool                            | in the kettle                           |
| <b>D</b> | in the pool                            | in the pool                             |

- 15** Water at 0 °C contracts as it is heated to 4 °C. Three students make statements about water.

Aricia As water cools from 4 °C to 0 °C, each molecule expands.

Bliss Convection currents do not occur in water between 0 °C and 4 °C.

Carla Water at 3 °C sinks in water at 1 °C.

Which student(s) is/are correct?

- A** Aricia **B** Bliss
- C** Aricia and Carla **D** Carla
- 16** In 2018, a junior football team became trapped inside the flooded Tham Luang Nang Non cave in Chiang Rai, Thailand for 17 days. Upon rescued, the boys were each wrapped with a thin sheet of shiny and silver material.

What was the effect of the sheet being shiny and silver rather than dull and black?

- A** It reflected less radiation from the boys, and the boys lost heat more quickly.
- B** It reflected less radiation from the boys, and the boys lost heat more slowly.
- C** It reflected more radiation from the boys, and the boys lost heat more quickly.
- D** It reflected more radiation from the boys, and the boys lost heat more slowly.
- 17** A block of aluminium is at room temperature. Which row describes a bigger block of aluminium at the same temperature?

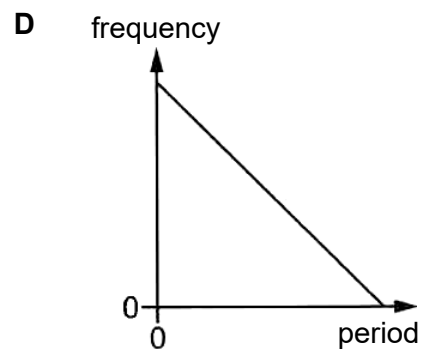
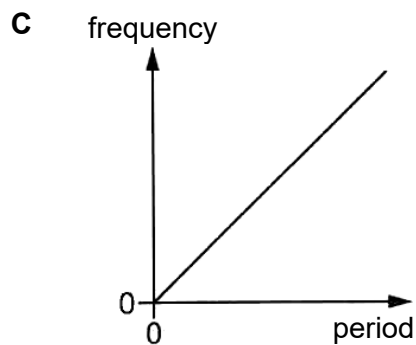
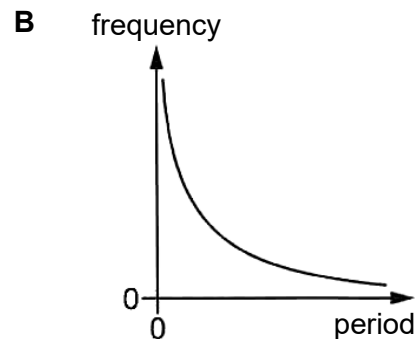
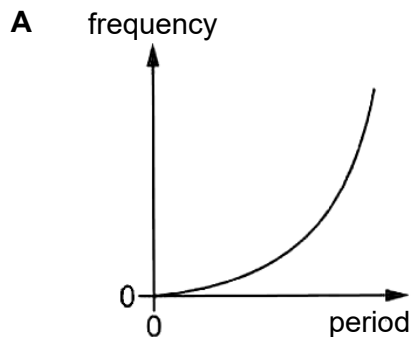
|          | internal energy | heat capacity | specific heat capacity |
|----------|-----------------|---------------|------------------------|
| <b>A</b> | more            | same          | more                   |
| <b>B</b> | same            | more          | more                   |
| <b>C</b> | more            | more          | same                   |
| <b>D</b> | same            | same          | same                   |

- 18 The energy needed to change a mass  $m$  of water to steam at  $100\text{ }^{\circ}\text{C}$  is  $L$ .

What does  $L$  represent?

- A the latent heat of fusion of a mass  $m$  of water
- B the latent heat of vaporisation of a mass  $m$  of water
- C the specific latent heat of fusion of water
- D the specific latent heat of vaporisation of water

- 19 Which graph shows how the frequency of a wave is related to its period?



- 20 A sound reaches Isaac through two different routes. The first route is through water. The second route is an equal distance through air. The speed of sound in air is  $340\text{ m/s}$  and the speed of sound in water is  $1\,500\text{ m/s}$ . Isaac first hears the sound  $0.50\text{ s}$  after the sound is emitted.

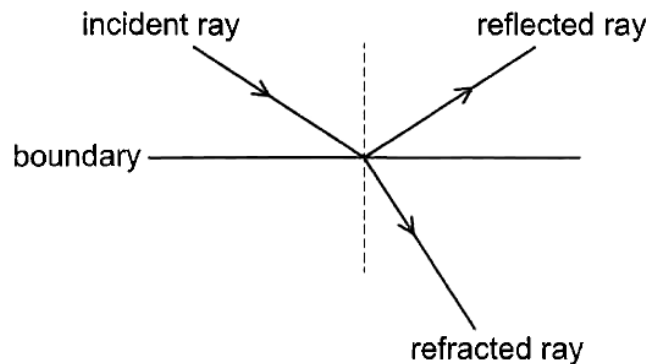
How long after first hearing does he hear the sound a second time?

- A 1.7 s
- B 2.2 s
- C 3.9 s
- D 4.4 s

- 21** The wavelength of infrared radiation is  $2 \times 10^{-5}$  m in vacuum.

What is the frequency of this infrared radiation?

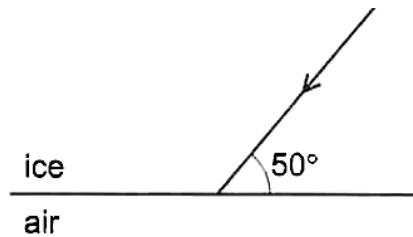
- A**  $1.5 \times 10^{13}$  Hz    **B**  $3.0 \times 10^8$  Hz    **C**  $2.0 \times 10^{-5}$  Hz    **D**  $6.7 \times 10^{-14}$  Hz
- 22** Which statement about microwaves is correct?
- A** They have a longer wavelength than visible light and can cause heating of body tissue.
- B** They have a longer wavelength than visible light and cannot cause heating of body tissue.
- C** They have a shorter wavelength than visible light and can cause heating of body tissue.
- D** They have a shorter wavelength than visible light and cannot cause heating of body tissue.
- 23** A ray of light is incident on the boundary between two mediums. Some of the light is refracted and some is reflected.



What is the same for the incident and refracted rays?

- A** brightness    **B** frequency    **C** speed    **D** wavelength

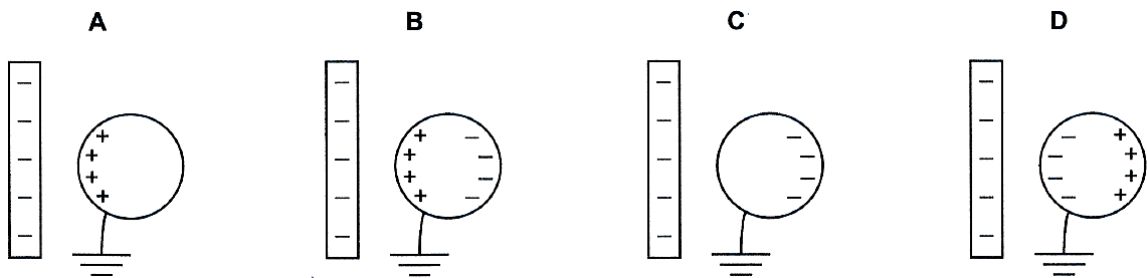
- 24** A ray of light passes from ice into air. The angle between the ray and the boundary is  $50^\circ$ . The refractive index of the ice is 1.3.



What is the angle of refraction of the light in air?

- A**  $33^\circ$                       **B**  $40^\circ$                       **C**  $57^\circ$                       **D**  $85^\circ$
- 25** A negatively-charged polythene rod is near to an earthed metal sphere.

Which diagram shows the distribution of charge on the sphere?

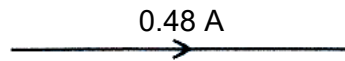


- 26** In some spray paint guns, particles of paint are given a positive charge as they leave the nozzle of the gun. The gun is placed close to the object to be painted.

Why is the object earthed?

- A** so that the positive charge from the paint flows to earth
- B** so that the user of the gun does not experience an electric shock
- C** to attract the particles of paint to the object
- D** to repel the paint droplets so that they spread out

- 27 There is a current of 0.48 A in a wire as shown.



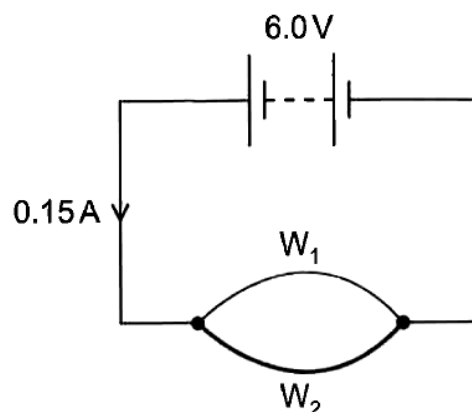
The charge on an electron is  $1.6 \times 10^{-19}$  C.

What is the rate of flow of electrons along the wire and in which direction do they move?

- A**  $8.0 \times 10^{-20}$  per second from left to right  
**B**  $3.0 \times 10^{18}$  per second from left to right  
**C**  $8.0 \times 10^{-20}$  per second from right to left  
**D**  $3.0 \times 10^{18}$  per second from right to left
- 28 A 2.0 m long wire with a radius of 1.0 mm has a resistance of 16  $\Omega$ .

What is the resistance of the same type of wire which is 4.0 m long and has a radius of 2.0 mm?

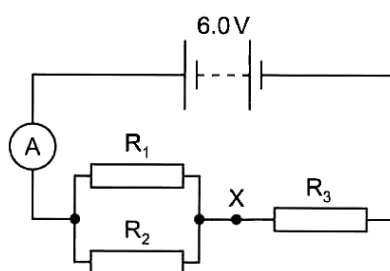
- A** 4  $\Omega$                       **B** 8  $\Omega$                       **C** 16  $\Omega$                       **D** 32  $\Omega$
- 29 Two wires,  $W_1$  and  $W_2$ , are made from the same material and have equal lengths. The thickness of  $W_2$  is twice of  $W_1$ . The wires are connected to a 6.0 V battery, as shown.



The current flowing out of the battery is 0.15 A. What is the resistance of wire  $W_2$ ?

- A** 50  $\Omega$                       **B** 60  $\Omega$                       **C** 120  $\Omega$                       **D** 200  $\Omega$

- 30** A 6.0 V battery is connected to three resistors and an ammeter as shown.



The reading on the ammeter is 0.20 A. There is a potential difference (p.d.) of 2.0 V across resistor  $R_1$ .

What is the current at X and the p.d. across  $R_3$ ?

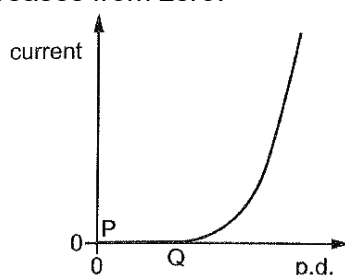
|          | current at X / A | p.d. across $R_3$ / V |
|----------|------------------|-----------------------|
| <b>A</b> | 0.10             | 2.0                   |
| <b>B</b> | 0.10             | 4.0                   |
| <b>C</b> | 0.20             | 2.0                   |
| <b>D</b> | 0.20             | 4.0                   |

- 31** The power produced in a resistor is  $P$ . The current flowing through the resistor is then doubled.

What is the new power produced in the resistor?

- A**  $\frac{P}{2}$                       **B**  $P$                       **C**  $2P$                       **D**  $4P$

- 32** The diagram shows how the current in a semiconductor diode varies as the potential difference (p.d.) across it increases from zero.



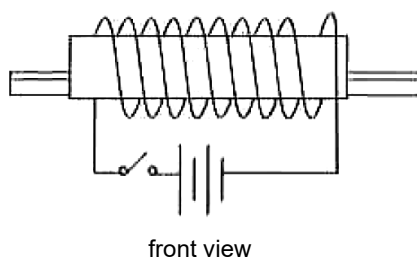
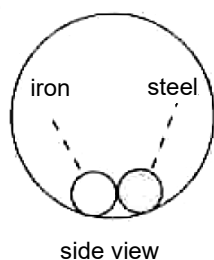
What is the resistance of the diode between P and Q, and how does it change as the p.d. increases from Q?

|          | resistance between P and Q | resistance after Q |
|----------|----------------------------|--------------------|
| <b>A</b> | zero                       | increases          |
| <b>B</b> | zero                       | decreases          |
| <b>C</b> | very large                 | increases          |
| <b>D</b> | very large                 | decreases          |

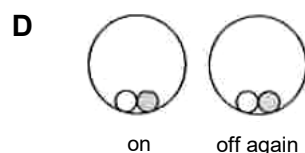
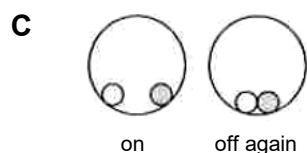
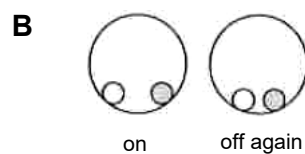
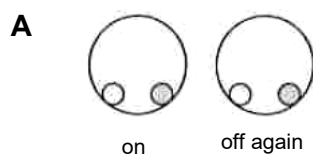
- 33** Which material is used for the needle of a plotting compass?

**A** copper      **B** iron      **C** steel      **D** tungsten

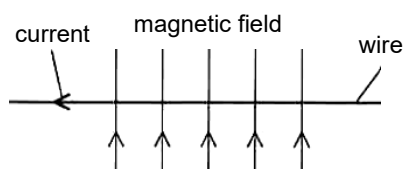
- 34** An iron rod and a steel rod are placed inside a solenoid which is connected to a strong d.c. supply.



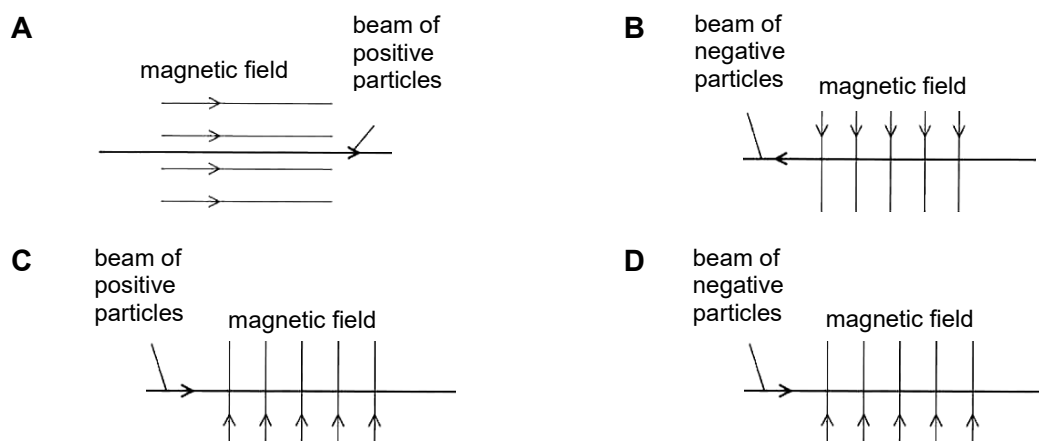
Which of the following shows the side view of the rods when the circuit is switched on for a while before switching it off again?



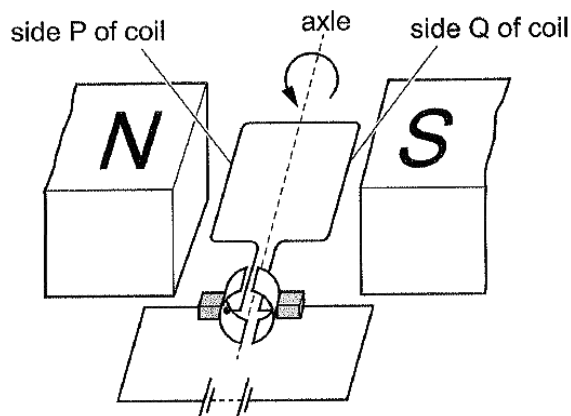
- 35 A straight wire carrying a current is placed perpendicular to a uniform magnetic field.



The wire experiences a force  $F$  perpendicular to the plane of the paper. In which diagram does the magnetic field produce a force on the wire or on the beam of charged particles that is in the opposite direction to  $F$ ?



- 36 The diagram shows a d.c. motor. The magnetic field between the N-pole and the S-pole is uniform.



At the position shown, the forces on sides P and Q are vertical and produce a moment about the axle. How and why does this moment change as the coil turns for  $\frac{1}{4}$  rotation?

|          | Moment    | As the coil turns,                                                 |
|----------|-----------|--------------------------------------------------------------------|
| <b>A</b> | decreases | the forces on P and Q change direction and are no longer vertical  |
| <b>B</b> | decreases | the perpendicular distance between the forces on P and Q decreases |
| <b>C</b> | increases | the forces on P and Q change direction and are no longer vertical  |
| <b>D</b> | increases | the perpendicular distance between the forces on P and Q decreases |

- 37 An a.c. generator has an output-induced e.m.f. of  $E$  and its coil rotates over a period of  $T$ .

What happens to the period and e.m.f. when the frequency of the coil in the generator decreases to a quarter of the original frequency?

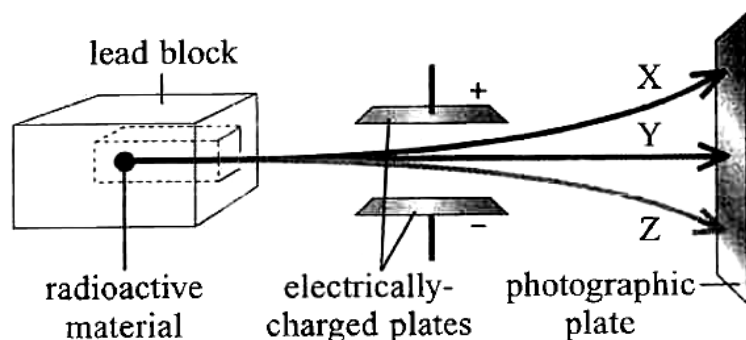
|          | period            | e.m.f.                      |
|----------|-------------------|-----------------------------|
| <b>A</b> | increases to $4T$ | increases to $4E$           |
| <b>B</b> | remains as $T$    | increases to $4E$           |
| <b>C</b> | increases to $4T$ | decreases to $\frac{1}{4}E$ |
| <b>D</b> | remains as $T$    | remains as $E$              |

- 38 A transformer has 400 turns on the primary coil and 1 200 turns on the secondary coil. The current in the primary coil is 0.60 A. Losses in the transformer cause the current in the secondary coil to be 90 % of the value for an ideal transformer.

What is the current in the secondary coil?

- A** 0.18 A                      **B** 0.20 A                      **C** 1.6 A                      **D** 1.8 A

- 39 A radioactive material emits three different radiations which pass through an electric field at right angle as shown.



Which of the following paths represent a beam of alpha particles, a beam of beta particles and gamma rays?

|          | X     | Y     | Z     |
|----------|-------|-------|-------|
| <b>A</b> | alpha | beta  | gamma |
| <b>B</b> | beta  | gamma | alpha |
| <b>C</b> | gamma | alpha | beta  |
| <b>D</b> | alpha | gamma | beta  |

- 40 If  $^{214}_{83}\text{Ra}$  becomes  $^{206}_{82}\text{Pb}$  in a radioactive decay, how many  $\alpha$  particles and  $\beta$  particles are produced?

|          | $\alpha$ particles | $\beta$ particles |
|----------|--------------------|-------------------|
| <b>A</b> | 1                  | 1                 |
| <b>B</b> | 2                  | 3                 |
| <b>C</b> | 3                  | 2                 |
| <b>D</b> | 4                  | 0                 |

**END OF PAPER**

**GESS Prelim Exam 2026 Physics 6091/01**

| Question | Answer | Explanation                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1        | A      | The seven base SI units are A, m, kg, s, K, mol and cd.                                                                                                                                                                                                                                                                                                                                                                                   |
| 2        | A      | Since $W$ is from east to west ( $\leftarrow$ ) and the boat's final position is due north ( $\uparrow$ ), $\therefore \uparrow R = V + W$ .                                                                                                                                                                                                                                                                                              |
| 3        | B      | Let the time taken to be $t$ .<br>area under speed-time graph = distance travelled.<br>$\frac{1}{2} \times at \times t = s$<br>$t = \underline{(2s / a)^{1/2}}$                                                                                                                                                                                                                                                                           |
| 4        | D      | All three took 4 s to complete a displacement of 20 m. Hence, they have the same average velocity, 5 m/s.                                                                                                                                                                                                                                                                                                                                 |
| 5        | D      | As the car accelerates to the right, the front wheels rotate clockwise and to the left on the road's surface. Hence, the direction of frictional force $F_1$ on the front wheels is to the right. The direction of the frictional force $F_2$ on the rear wheels acts in the backward direction (opposite to the car's forward motion) to provide the moment needed to make the unpowered wheels spin clockwise as the car moves forward. |
| 6        | D      | Since the object is moving at steady velocity, it experiences no net force. However, for an action-reaction pair, they must act on two different objects.                                                                                                                                                                                                                                                                                 |
| 7        | D      | By the principle of moments, $24 \text{ N} \times 0.50 \text{ m} = F \times 0.30 \text{ m}$<br>$\downarrow F = 40 \text{ N}$<br>Since the stick is balanced, it has no resultant force and no resultant moment.<br>Upward force exerted by his shoulder = $24 \text{ N} + F$<br>= $24 \text{ N} + 40 \text{ N}$<br>= <b><u>64 N</u></b>                                                                                                   |
| 8        | A      | To make the object less stable, you can raise its centre of gravity and/or decrease its base area. Options <b>B</b> and <b>C</b> do not change the position of its centre of gravity. Option <b>D</b> lowers its centre of gravity, while option <b>A</b> raises its centre of gravity.                                                                                                                                                   |
| 9        | B      | Atmospheric pressure is acting on the surface of the ocean. As the depth $d$ below the surface of the ocean increases, the pressure $P$ of the gas in the bubble also increases. Since fluid pressure $P = h\rho g$ (that is, $d\rho g$ ), the graph of $P$ against $d$ shows a linear relationship between $P$ and $d$ , and it will start from atmospheric pressure when $d = 0$ .                                                      |

| Question | Answer | Explanation                                                                                                                                                                                                                                                                                                                                          |
|----------|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 10       | A      | Both spheres are made of nickel and must have the same density. Since the volume of $N$ is less than that of $M$ , the mass of $N$ is also less than that of $M$ . $N$ , having a smaller mass, will have less weight than $M$ .                                                                                                                     |
| 11       | C      | Since the stone enters a deep pool at high speed, it has both energy in kinetic store and gravitational potential store as it moves towards the bottom of the pool. These energies are then transferred to internal store mechanically.                                                                                                              |
| 12       | C      | work done to slow the train down = change in energy in kinetic store<br>$= \frac{1}{2} \times 40\,000 \times (30^2 - 25^2)$<br>$= 5\,500\,000 \text{ J}$<br>$= \underline{\underline{5.5 \text{ MJ}}}$                                                                                                                                               |
| 13       | B      | As the gas is cooled down, there is less energy in kinetic store, and the speed of the molecules decreases. The piston moves inwards and there are more gas molecules per unit volume. Hence, the gas molecules will collide with the piston more frequently and the rate of collision increases.                                                    |
| 14       | C      | The water in the kettle has a higher temperature, thus it has greater average energy in the kinetic store. However, the water in the pool has greater total energy in internal store as it has greater volume and more molecules than the water in the kettle.                                                                                       |
| 15       | D      | From $0^\circ\text{C}$ to $4^\circ\text{C}$ , water contracts, decreases in volume and becomes denser. Hence, convection currents can still occur. The size of water molecule cannot change.                                                                                                                                                         |
| 16       | D      | The boys lost heat from their bodies to the cold surroundings. To minimise heat loss from the boys, the shiny and silver material reflects more radiant heat back to their bodies.                                                                                                                                                                   |
| 17       | C      | The two blocks are made of the same material, steel, thus they must have the same specific heat capacity. Since heat capacity = mass $\times$ specific heat capacity, heat capacity is more with a bigger block which a larger mass. There is greater total energy in internal store in the bigger block as it has more particles and a larger mass. |
| 18       | B      | At $100^\circ\text{C}$ , water boils to become steam.<br>thermal energy = mass $\times$ specific latent heat of vaporisation<br>$L = ml_v$                                                                                                                                                                                                           |
| 19       | B      | Frequency is inversely proportional to period.                                                                                                                                                                                                                                                                                                       |

| Question | Answer | Explanation                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 20       | A      | Sound travels faster in water than in air. Let $x$ be the distance between Isaac and where the sound is emitted. $x = 1\,500\text{ m/s} \times 0.50\text{ s} = 750\text{ m}$ .<br>Time taken for the sound heard by Isaac in air<br>$= 750\text{ m} \div 340\text{ m/s} = 2.2\text{ s}$<br>Time between the first sound and second sound $= 2.2\text{ s} - 0.5\text{ s} = \underline{\mathbf{1.7\text{ s}}}$                                                     |
| 21       | A      | $v = f\lambda$<br>$3.0 \times 10^8 = f \times (2.0 \times 10^{-5})$<br>$f = \underline{\mathbf{1.5 \times 10^{13}\text{ Hz}}}$                                                                                                                                                                                                                                                                                                                                   |
| 22       | A      | Microwaves have a longer wavelength and lower frequency than visible light. They can cause heating of body tissues.                                                                                                                                                                                                                                                                                                                                              |
| 23       | B      | Only the frequency remains the same as the light rays are from the same light source.                                                                                                                                                                                                                                                                                                                                                                            |
| 24       | C      | $1.3 = \sin r / \sin (90^\circ - 50^\circ)$<br>$r = \underline{\mathbf{57^\circ}}$                                                                                                                                                                                                                                                                                                                                                                               |
| 25       | A      | Since like charges repel, negative charges will move to the right side of the sphere away from the negatively charged rod. There are excess negative charges on the right side of the sphere. As the sphere is earthed and only negative charges can move, negative charges will move from the right side of sphere to the ground. Negative charges cannot move from the ground to the left side of sphere due to the repulsion from the negatively charged rod. |
| 26       | C      | The object is earthed and becomes electrically neutral. Paint droplets, being lighter, will be attracted to the object as charged particles attract neutral object. The user does not need to touch the object being painted.                                                                                                                                                                                                                                    |
| 27       | D      | The direction of electron flow is opposite to the direction of current. There is a charge of $0.48\text{ C}$ in the wire per second. Since the charge on an electron is $1.6 \times 10^{-19}\text{ C}$ , there are $0.48\text{ C} \div (1.6 \times 10^{-19}\text{ C}) = \underline{\mathbf{3.0 \times 10^{18}}}$ electrons flowing from right to left in one second.                                                                                             |
| 28       | B      | $R = \frac{\rho l}{A}$<br>$R = 16\ \Omega \times \left(\frac{4.0}{2.0}\right) \div \left(\frac{2.0}{1.0}\right)^2$<br><br>$= \underline{\mathbf{8.0\ \Omega}}$                                                                                                                                                                                                                                                                                                   |

| Question | Answer | Explanation                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 29       | A      | Since the thickness of $W_2$ is twice of $W_1$ , the resistance of $W_2$ will be $\frac{1}{4}$ of $W_1$ . Current flowing through $W_2 = [(0.15 \text{ A}) / 5] \times 4 = 0.12 \text{ A}$ .<br>Resistance of $W_2 = 6.0 \text{ V} / 0.12 \text{ A} = \underline{50 \Omega}$                                                                                                                                                               |
| 30       | D      | $R_1$ is parallel to $R_2$ , and they are in series with $R_3$ .<br>current at X = current through $R_1$ + current through $R_2 = \underline{0.20 \text{ A}}$<br>p.d. across $R_3 = 6.0 \text{ V} - 2.0 \text{ V} = \underline{4.0 \text{ V}}$                                                                                                                                                                                             |
| 31       | D      | Since $P = I^2 R$ , when the current $I$ is doubled, the new power will be quadrupled and become $4P$ .                                                                                                                                                                                                                                                                                                                                    |
| 32       | D      | The reciprocal of the gradient of the graph of current against p.d. is the resistance of the diode. Since the gradient PQ is zero, the resistance between P and Q is infinite (very large). After Q, the gradient increases, thus the resistance decreases.                                                                                                                                                                                |
| 33       | C      | The material used for the needle of a plotting compass must be a hard magnetic material which is hard to magnetise and demagnetise and retains its magnetism. Both copper and tungsten are non-magnetic materials. Iron is a soft magnetic material which magnetises and demagnetises easily.                                                                                                                                              |
| 34       | C      | When the circuit is closed, the strong direct current causes both rods to magnetise with the same polarity. Both rods will repel from each other as like poles repel. When the circuit is opened, steel, being a hard magnetic material, will retain its magnetism, while iron, being a soft magnetic material, will lose its magnetism immediately. The steel rod will induce magnetism on the iron rod and both will attract each other. |
| 35       | C      | Using Fleming's Left-Hand Rule, the wire experiences a force $F$ pushing it into the page. The force in the opposite direction to $F$ must be out of the page. There is no force acting on <b>A</b> , and the force acting on <b>B</b> and <b>D</b> is into the page.                                                                                                                                                                      |
| 36       | B      | As the coil turns, the perpendicular distance between the axle and the line of action of downward force on P decreases, thus moment decreases (moment = force $\times$ perpendicular distance). This is the same to the moment due to the upward force on Q about the axle.                                                                                                                                                                |
| 37       | C      | The rate of change of magnetic flux is proportional to the induced e.m.f.. When the frequency of rotation of the coil is reduced to $\frac{1}{4}$ of the original speed, the time taken to complete one rotation increases by 4 times ( $4T$ ) and the induced e.m.f. also reduces to $\frac{1}{4} E$ .                                                                                                                                    |

| Question | Answer | Explanation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 38       | A      | $\frac{N_p}{N_s} = \frac{I_s}{I_p}$ $\frac{400}{1200} = \frac{I_s}{(90\% \times 0.60)}$ $I_s = \underline{\underline{0.18 \text{ A}}}$                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 39       | B      | <p>An alpha particle consists of two protons and two neutrons tightly bound together. A beta particle is a fast-moving electron ejected from a radioactive nucleus. A gamma ray is electromagnetic radiation emitted by a nucleus with excess energy. As like charges repel and unlike charges attract, alpha particles will be attracted to the negatively-charged plate and beta particles will be attracted to the positively-charged plate. Gamma rays have no charge and will not be affected by the electrically-charged plates, thus the rays travel along its original path.</p> |
| 40       | B      | ${}_{83}^{214}\text{Ra} \rightarrow {}_{82}^{206}\text{Pb} + 2{}_2^4\alpha + 3{}_{-1}^0\beta$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |