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CLASS:	
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YISHUN TOWN SECONDARY SCHOOL

PRELIMINARY EXAMINATION 2022

SEC 4 EXPRESS

PHYSICS

(6091/1)

DATE : 12 Sep 2022

DAY : Monday

DURATION: 1 hr

MARKS: 40 marks

ADDITIONAL MATERIALS

Multiple Choice Answer Sheet (OMS)

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number in the spaces provided at the top of this page.

There are forty questions. 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 answer sheet. Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

INFORMATION FOR CANDIDATES

Any rough working should be done in this booklet.

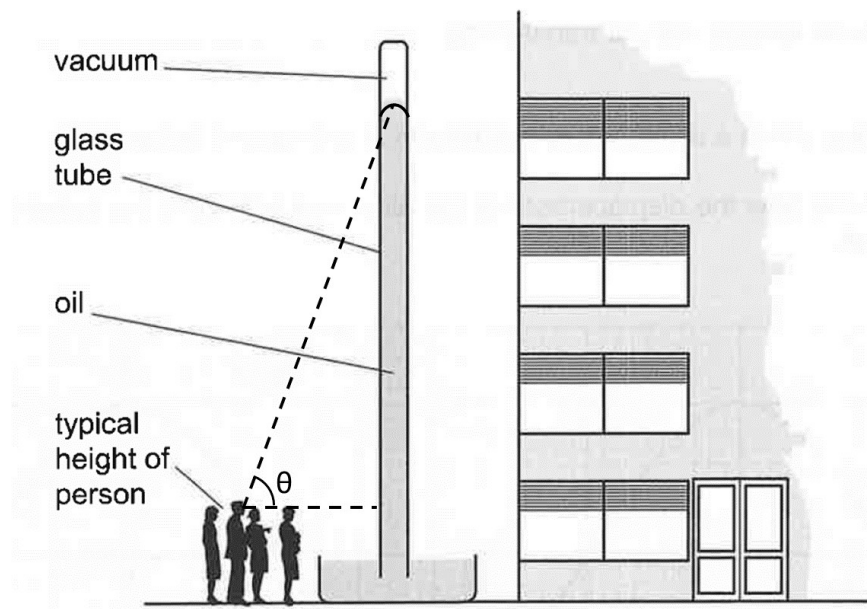
You may use an approved calculator.

1 The average mass of a feather is 8.2 mg. What is the mass in microgram?

- A** $8.2 \times 10^{-9} \mu\text{g}$
C $8.2 \times 10^3 \mu\text{g}$

- B** $8.2 \times 10^{-3} \mu\text{g}$
D $8.2 \times 10^9 \mu\text{g}$

2 The diagram shows the tallest oil barometer in the world. It is about 4 stories tall. The average height of each storey is about 3 m tall and the density of oil is already known.



What instruments are needed to measure the atmospheric pressure with this barometer?

1. a 10 m tape measure
2. a meter rule
3. an inclinometer, which measures θ

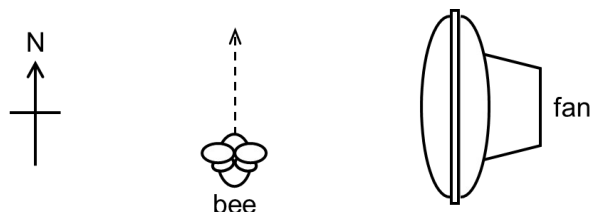
A 1 only

B 2 only

C 1 and 3 only

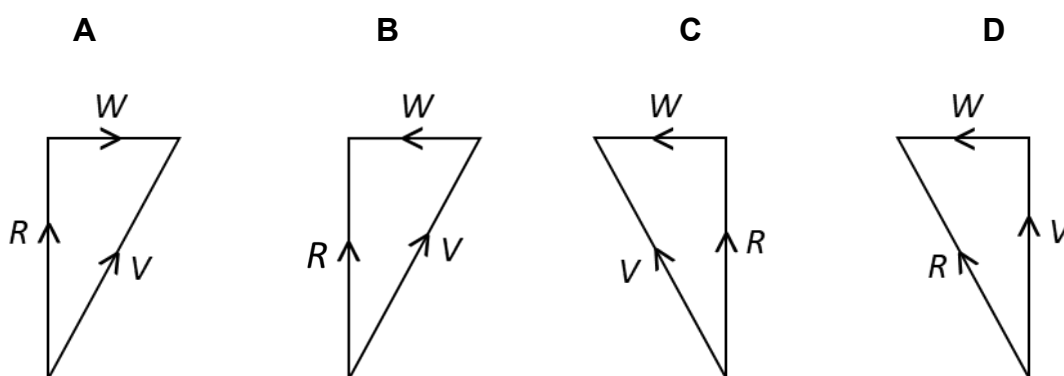
D 2 and 3 only

- 3 A bee is flying across a room with a standing fan in it.



The bee crosses the room and arrives at a point due north of its starting point. The bee has a speed of V in still air. The fan blowing from east to west causes the bee to move with a speed of W in the same direction.

Which diagram represents the resultant velocity R of the bee?



- 4 An object falls from rest through the air and reaches terminal velocity. Which statement describes its acceleration?

- A It is constant and is equal to 0 m/s^2 .
- B It is constant and is equal to 10 m/s^2 .
- C It increases from 0 m/s^2 to 10 m/s^2 .
- D It decreases from 10 m/s^2 to 0 m/s^2 .

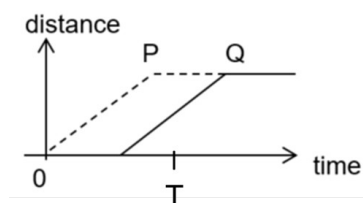
- 5 A car travels past three lamp posts, M, N and O. The car takes 2.0s to drive from M to N, which is 30 m apart. The average speed of the car when it travels from M to O is 20 m/s. The distance between M and O is 80 m.



What is the estimated speed of the car when it travels from N to O?

- A 5.0 m/s
- B 15 m/s
- C 20 m/s
- D 25 m/s

- 6 Which statement best describes a gravitational field?
- A It is a region in which an object experiences a force due to its mass.
 - B It is a region in which an object experiences a force due to its acceleration.
 - C It is a region in which an object experiences an acceleration due to its mass.
 - D It is a region in which an object experiences an acceleration due a force.
- 7 A stunt man freefalls from rest and opens his parachute 2.3 s later. What is his velocity just before he opens his parachute?
- A 1.0 m/s
 - B 2.3 m/s
 - C 10 m/s
 - D 23 m/s
- 8 Which statement about velocity or acceleration is true?
- A When the velocity = 0 m/s, acceleration must also be 0 m/s².
 - B When acceleration of an object is positive, the object must be speeding up.
 - C The direction of velocity and the direction of motion is always the same.
 - D The direction of acceleration and the direction of motion is always the same.
- 9 The graph shows the distance travelled by two cars, P and Q, over a period of time.



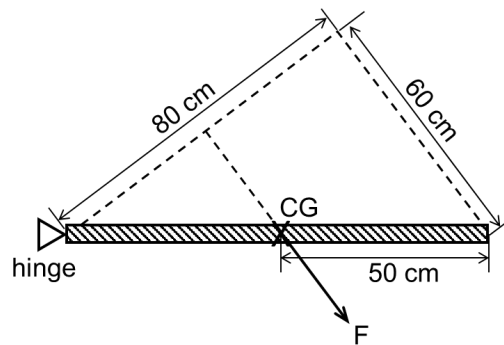
Which statement about car P and Q at time T is correct?

- A Car P is faster than car Q.
 - B Car P is ahead of car Q.
 - C Car Q is accelerating.
 - D Car Q is not moving.
- 10 A block is resting on a table. Two forces act on it: the weight, W, and the normal contact force, N.

Which force, with W, makes an action-reaction pair?

- A The force acting on the block by the table.
- B The force acting on the block by the Earth.
- C The force acting on the table by the block.
- D The force acting on the Earth by the block.

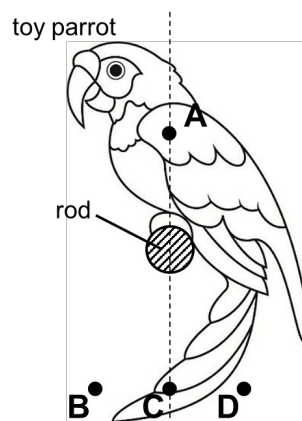
- 11** Which word describes the reluctance of an object to resist a change to its current state of motion?
- A** inertia **B** force
C opposition **D** resistance
- 12** A uniform rod is hinged at one end. There is an applied force, F , acting on the rod at its center of gravity (CG).



What is the size of the moment produced by F about the hinge?

- A** 40F Ncm **B** 50F Ncm **C** 60F Ncm **D** 80F Ncm
- 13** The diagram shows a toy parrot pivoted on a rod at its equilibrium orientation. This toy is designed not to fall over even when it is displaced.

Where is the position of its center of gravity?

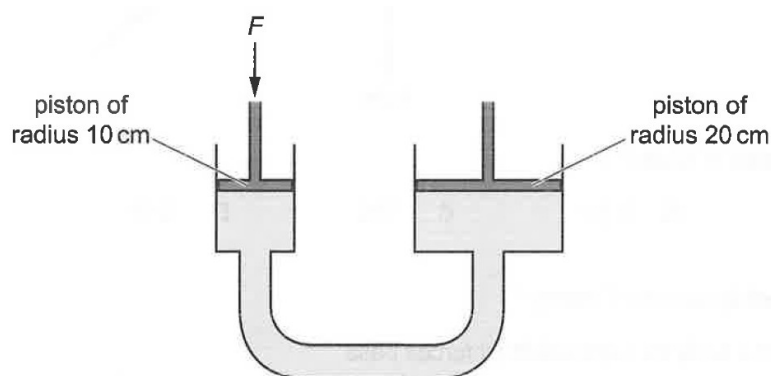


- 14** A barometer is placed in a room pressurized to 150 000 Pa. The density of mercury and the pressurized air is 14 000 kg/m³ and 1.2 kg/m³ respectively.

What is the reading on the barometer?

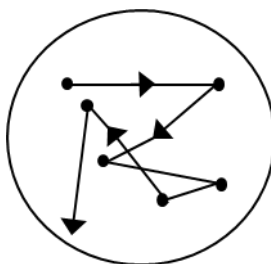
- A** 1.1 cmHg **B** 110 cmHg **C** 130 cmHg **D** 1300 cmHg

- 15 When a force, F , is applied to the smaller piston of a hydraulic press, as shown, the small piston moves down by a distance, D .



How far upwards will the larger piston move?

- A** $D/4$ **B** $D/2$ **C** $2D$ **D** $4D$
- 16 Which of the following is not a unit of energy?
- A** J **B** kWh **C** W **D** VC
- 17 A 80 g box slides across a horizontal rough surface. The average resistive force acting on the box is 0.40 N.
- How far will the box travel when its initial velocity is 3.0 m/s?
- A** 0.30 m **B** 0.90 m **C** 300 m **D** 900 m
- 18 Smoke particles in a transparent box are observed using a microscope. A small point of light is seen to move around as shown.



When the temperature in the box is raised, what change can be observed under the microscope?

- A** The small point of light increases in size.
B The small point of light glows brighter.
C The small point of light moves slower.
D The small point of light changes direction more frequently.

- 19** When a fixed mass of gas expands rapidly, the temperature of the gas will decrease rapidly.

What happens to the pressure of the gas and the average speed of the gas molecules?

	pressure of gas	average speed of the gas molecules
A	decreases	decreases
B	decreases	remains the same
C	increases	remains the same
D	increases	decreases

- 20** A liquid changes state by freezing. Which statement about this change is correct?

- A** Energy is gained during this change.
- B** The internal energy of the substance decreases.
- C** The temperature of the substance decreases.
- D** The intermolecular bonds are weakened.

- 21** The mercury column in a liquid-in-glass thermometer is 6.0 cm and 48 cm long at the lower and upper fixed points respectively.

What is the temperature when the mercury column is 14 cm long?

- A** 1.9 °C **B** 3.4 °C **C** 19 °C **D** 34 °C

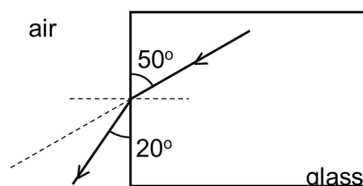
- 22** In an experiment, a 30 W heater is used to heat 15 g of ice at 0 °C. The specific latent heat of fusion is 340 J/g. How much ice remains after 2 minutes of heating?

- A** 0.18 g **B** 4.4 g **C** 11 g **D** 14 g

- 23** When a liquid is heated, its temperature increases while its volume shows negligible change. Which row shows the change in the kinetic and potential energies of the molecules?

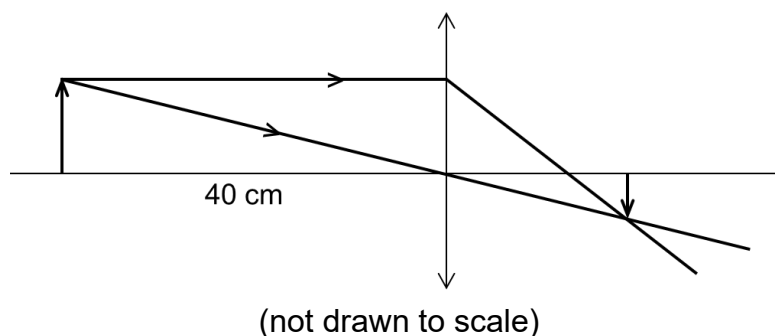
	kinetic energy	potential energy
A	decreases	increases
B	decreases	remains the same
C	increases	remains the same
D	increases	increases

- 24** A beam of light is incident across the glass-air boundary.



What is the angle of deflection?

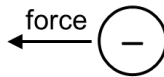
- A** 20° **B** 30° **C** 40° **D** 50°
- 25** Which of the following is not used in calculating the refractive index of the medium?
- A** angle of refraction **B** critical angle of the medium
C frequency of the light **D** velocity of light in the medium
- 26** The diagram shows an object placed 40 cm in front of a thin converging lens used to form a real image in a camera.



What is the focal length of this lens?

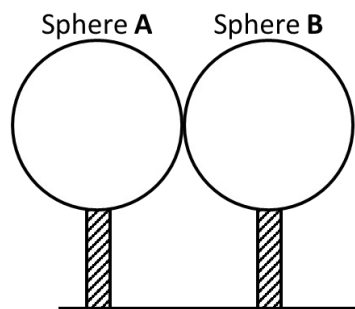
- A** 10 cm **B** 20 cm **C** 30 cm **D** 50 cm
- 27** Which of the following is true for all EM waves?
- A** cannot be blocked by opaque objects
B can be blocked by opaque objects
C travel at the same speed in water
D can undergo total internal reflection
- 28** Nana stands 330 m away from a large wall and claps once. She hears another clap sometime later. When compared to the first clap, how is the second clap expected to be?
- A** have lower pitch **B** have a slower speed
C have a shorter wavelength **D** have a smaller amplitude

- 29** A stationary negative charge in an electric field experiences an electric force in the direction shown.



What is the direction of the electric field?

- | | |
|-----------------------------|-----------------------------|
| A from left to right | B from right to left |
| C from top to bottom | D into the paper |
- 30** Two identical neutral conducting spheres, A and B, are supported by insulating stands and touching each other as shown.

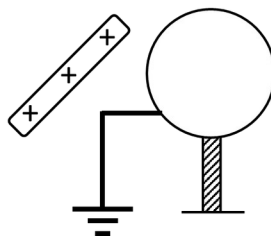


Another identical but strong negatively charged conducting sphere, C, touches sphere A.

What will be the resulting charge on each sphere and how is their charge strength compared to each other?

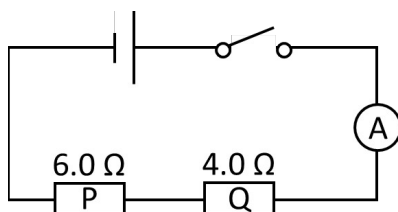
- | | |
|----------|---|
| A | Sphere C is neutralized. Sphere A and B become negatively charged but A is more charged than B. |
| B | Sphere C is neutralized. Sphere A and B become negatively charged with equal strength. |
| C | Sphere A, B and C are negatively charged but C remains more charged than B and A. |
| D | Sphere A, B and C are negatively charged with equal strength. |

- 31 A positively charged rod is held close to an earthed metal sphere.



Which of the following describes the movement of charges?

- A** Positive charges in the sphere are repelled away to the Earth through the earth wire.
B Negative charges in the sphere are repelled away to the Earth through the earth wire.
C Negative charges in the Earth are attracted to the sphere due to the positively charged rod.
D Negative charges in the Earth are attracted to the sphere but is blocked by the negatively charged right hand side of the sphere.
- 32 In 4.0 s, 4.2×10^{19} electrons pass through a resistor. As the electrons pass, thermal energy is produced in the resistor at a rate of 6.0 W. The charge on an electron is 1.6×10^{-19} C. What is the potential difference across the resistor?
- A** 0.28 V **B** 0.89 V **C** 3.6 V **D** 9.1 V
- 33 Which electrical component converts an alternating current into direct current?
- A** thermistor **B** semiconductor diode
C battery **D** resistance wire
- 34 The diagram shows a circuit with two lamps, P and Q, of 6.0Ω and 4.0Ω respectively. The ammeter reads 2.0 A.



What is the ratio of current flowing through P and Q?

- A** 3/2 **B** 2/3 **C** 1/1 **D** 2/1

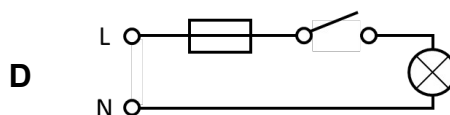
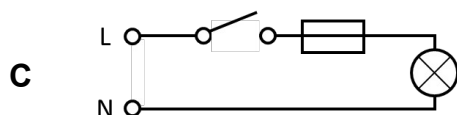
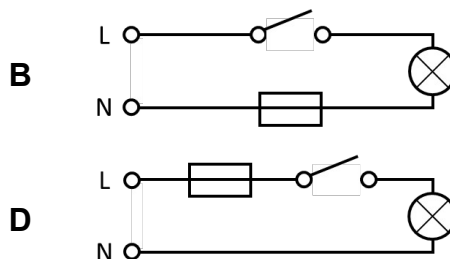
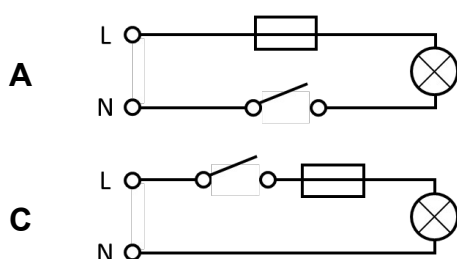
- 35** The diagram shows a potential divider.



Which row will result in the largest potential difference across the output?

	R	light intensity
A	low resistance	bright
B	high resistance	bright
C	low resistance	dim
D	high resistance	dim

- 36** A lamp has a switch and is connected to a plug with a fuse. In which circuit are the switch and fuse connected correctly?



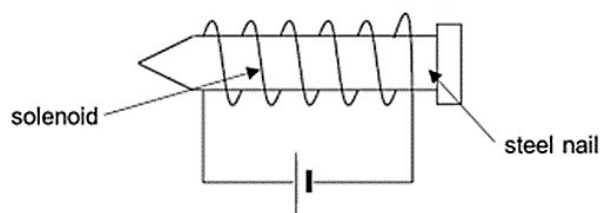
- 37** What are the conditions for a particle to experience a force in a magnetic field?

1. The particle must be charged.
2. The particle must be moving.
3. The particle must be travelling perpendicular to the direction of the magnetic field.

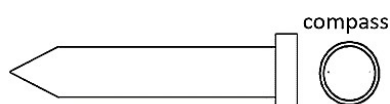
- A** 1 and 3 only
C 2 and 3 only

- B** 1 and 2 only
D 1, 2 and 3

- 38** A steel nail is placed in a solenoid as shown.



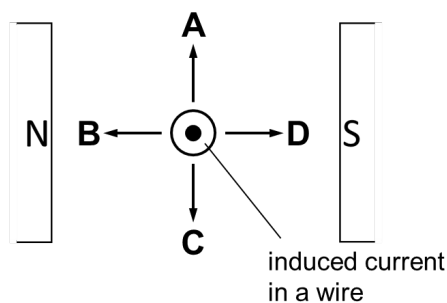
After some time, the switch is open and the nail is removed from the solenoid. A compass is then placed on the right side of the nail.



What will the compass show?



- 39** The diagram shows an induced current flowing through a wire between the poles of a magnet. What is the direction of the force applied on the wire?



- 40** What can be done to reduce heating in a transformer while maintaining its efficiency?

- A** increase the number of turns on each side of the transformer.
- B** use a laminated iron core instead of a solid iron core.
- C** use a steel core instead of an iron core.
- D** use iron wires instead of copper wires.

END OF PAPER

ANSWER KEY

Ques	Reference From	Ans		Ques	Reference From	Ans
1		C		21		C
2	O LvL 2021 Q4b	C		22		B
3	O LvL 2021 Q1	A		23		C
4		D		24		B
5		D		25		C
6		A		26		A
7	4E MYE 2022 Q1	D		27		D
8	4E MYE 2022 Q3	C		28		D
9	3E EOY 2021 Q8	B		29	4E MYE Q10	A
10	O LvL 2022 Q4	D		30	4E MYE Q11	D
11	3E EOY 2021 Q13	A		31	O LvL 2021 Q30	C
12	O LvL 2021 Q9	A		32	4E MYE Q16	C
13		C		33		B
14		B		34		C
15	O LvL 2021 Q13	A		35		B
16		C		36		D
17		B		37		B
18	3E EOY Q23	D		38	WS21.5 Q1	D
19	O LvL 2021 Q19	A		39		C
20		B		40		B