BCCS BCCS BCCS BCCS BCCS BCCS BCCS BCCS	SINGAPORE CHINESE GIRLS' SCHOOL PRELIMINARY EXAMINATION 2022 SECONDARY FOUR
CANDIDATE NAME	
CLASS	REGISTER NUMBER

1 Hour

PHYSICS

PAPER 1 Multiple Choice

Monday

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil. Do not use staples, paper clips, glue or correction fluid. Write your name, class and index number on the Question Paper **and** Answer Sheet in the spaces provided.

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

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

Read the instructions on the Answer Sheet 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. Take $g = 10 \text{ ms}^{-2}$ or 10 Nkg^{-1} unless specified otherwise. 1 A student is given a reel of wire of diameter less than 0.2 mm and is asked to find the density of the metal.

Which pair of instruments would be most suitable for finding the volume of the wire?

- A Balance and micrometer
- **B** Metre rule and micrometer
- **C** Metre rule and vernier calipers
- D Micrometer and vernier calipers
- 2 The diameter of a solid metal sphere is measured using a micrometer screw gauge. The diagram shows an enlargement of the shaft of the micrometer screw gauge when taking the measurement.



The mass of the sphere is 0.450 g.

What is the density of the metal used to make the sphere?

- **A** 965 kg m⁻³
- **B** 1340 kg m⁻³
- C 7720 kg m⁻³
- **D** 10 700 kg m⁻³

3 Paths are laid as shown between points X, Y and Z.



A person walks along the paths from X to Y to Z and then back to X.

What is the value of the total displacement and of the total distance travelled?

	total displacement / m	total distance travelled / m		
Α	0	0		
в	0	30		
С	30	0		
D	30	30		

4 Two tugs are towing an oil rig as shown



The tensions in the towing cables are 4.0 kN and 5.0 kN.

What is the total force acting on the rig due to the cables, in the direction to the east?

- **A** 3.1 kN
- **B** 5.2 kN
- **C** 7.0 kN
- **D** 8.3 Kn

5 A car accelerates uniformly from velocity *u* to velocity *v* in time t.



On the graph, which area equals the distance travelled by the car in time t?

- A NPTU + PQST
- B NPWV + VRSU
- C NPWV + WRST
- D PST + PQS
- 6 A raindrop falls vertically from rest in air. The variation with time of the speed of the raindrop is shown in the graph.



Which statement about the raindrop is correct?

- **A** At point X, the raindrop has an acceleration of 10 m s^{-2} .
- **B** At point Z, the force on the raindrop due to air resistance has reached its maximum value and so the acceleration of the raindrop has also reached its maximum value.
- **C** At point Z, the force due to air resistance is equal and opposite to the weight of the raindrop and so the speed of the raindrop is zero.
- **D** The resultant force on the raindrop at point Y is less than the resultant force on the raindrop at point X.

7 A sphere is released and falls. Its initial acceleration decreases until it eventually begins to travel at constant terminal velocity. Which displacement-time graph best represents the motion of the sphere?



8 The acceleration of free fall on the Moon is 1.6 m s⁻². The Moon has no atmosphere. An astronaut standing on the surface of the Moon drops a feather.

Which graph shows the variation with time of the speed of the feather during the first second of its fall?



9 A car travels along a straight horizontal road. The graph shows the variation of the velocity v of the car with time t for 6.0 s of its journey.



The brakes of the car are applied from t = 1.0 s to t = 4.0 s.

How far does the car travel while the brakes are applied?

- **A** 21 m
- **B** 45 m
- **C** 67 m
- **D** 83 m
- **10** A submarine descends vertically at constant velocity. The three forces acting on the submarine are drag, upthrust and weight as shown in the diagram below.



Which relationship between their magnitudes is correct?

- **A** $W \neq D + U$
- **B** *W* > *D* + *U*
- $\mathbf{C} \qquad W = D + U$
- $\mathbf{D} \qquad W < D + U$

11 A U-tube containing water is used as a manometer.



When one end of the manometer is connected to a low-pressure chamber, both water levels in the manometer change by 20 cm. The gravitational field strength g is 10 N/kg.

The density of water is 1000 kg/m^3 .

How far below atmospheric pressure is the pressure in this chamber?

- A 2000 Pa
- **B** 4000 Pa
- **C** 200000 Pa
- **D** 400000 Pa



A graph is plotted to show the relationship between the pressure exerted on the table and the base area of the block.

Which graph shows this relationship?



13 The diagram shows a muscle and bones in a person's arm. The hand holds a load of weight 40 N. The elbow acts as a pivot and the tension in the muscle keeps the lower part of the arm horizontal.



What is the tension in the muscle due to the load?

- A 200 N
- **B** 240 N
- **C** 280 N
- **D** 1400 N

12 Five blocks have the same mass but different base areas. They all rest on a horizontal table.

14 A uniform solid block has weight 500 N, width 0.4 m and height 0.6 m. The block rests on the edge of a step of depth 0.8 m, as shown.



The block is knocked over the edge of the step and rotates through 90° before coming to rest with the 0.6 m edge horizontal.

What is the change in gravitational potential energy of the block?

- **A** 300 J
- **B** 400 J
- **C** 450 J
- **D** 550 J
- **15** A student can run or walk up the stairs to her classroom.

Which statement describes the power required and the gravitational potential energy gained while running up the stairs compared to walking up them?

- **A** Running provides more gravitational potential energy and uses more power.
- **B** Running provides more gravitational potential energy and uses the same power.
- **C** Running provides the same gravitational potential energy and uses more power.
- **D** Running provides the same gravitational potential energy and uses the same power

reservoir 300 m turbine house

16 The diagram shows a hydroelectric power station.

The reservoir is 300 m above the level of the turbine and is linked to it by a pipe.

Water from a reservoir is fed to the turbine of a hydroelectric system at a rate of 500 kg s^{-1} . The electrical output from the generator driven by the turbine is 200 A at a potential difference of 6000 V.

What is the efficiency of the generator ?

- **A** 8.0 %
- **B** 8.2%
- **C** 80%
- **D** 82%
- 17 What happens when a solid is heated and expands?
 - A The molecules do not change size and the spaces between the molecules become larger.
 - **B** The molecules expand and the spaces between the molecules become larger.
 - **C** The molecules expand and the spaces between the molecules become smaller.
 - **D** The molecules expand and the spaces between the molecules do not change size.

18 Some of the liquid in a dish evaporates, as shown in the diagrams.



Which molecules leave the liquid and which molecules in the liquid have greater average kinetic energy?

	molecules that leave have	molecules in the liquid have greater average kinetic energy		
Α	high energy	before evaporation		
В	high energy	after evaporation		
С	low energy	before evaporation		
D	low energy	after evaporation		

19 An electric shower takes in cold water at 17 °C. The shower gives 6000 J of energy every second to the cold water and heats it to 37 °C. The specific heat capacity of water is 4200 J/(kg °C).

What is the mass of hot water supplied by the shower in one second?

- A 0.035 kg
- **B** 0.039 kg
- **C** 0.071 kg
- **D** 0.084 kg
- 20 Latent heat of vaporisation is
 - A the energy required to make molecules expand
 - **B** the energy required to make molecules expand and move apart
 - **C** the energy required to make molecules move apart
 - **D** the energy required to make molecules move faster

21 A ray of light in a transparent medium of refractive index 1.8 is incident on the surface as shown. The light then enters air.



What is the angle between the refracted ray and the normal in air?

- **A** 29°
- **B** 33°
- **C** 54°
- **D** 64°
- **22** A plastic tube is immersed in a liquid of refractive index 1.4. Light travelling in the plastic tube strikes the inside surface at an angle of incidence of 70°. The light undergoes total internal reflection.



What describes the values of the critical angle in the plastic and the refractive index of the plastic?

	critical angle in plastic refractive index of plastic		
Α	greater than 70°	greater than 1.4	
В	greater than 70°	less than 1.4	
С	less than 70°	greater than 1.4	
D	less than 70°	less than 1.4	
C D	less than 70° less than 70°	greater than 1.4 less than 1.4	

An object is viewed through a converging lens.The diagram shows the paths of two rays from the top of the object to an eye.



How does the image compare with the object?

- A It is larger and inverted.
- **B** It is larger and upright.
- C It is smaller and inverted.
- **D** It is smaller and upright.

24 Which equation is used to define resistance?

- **A** energy = $(current)^2 \times resistance \times time$
- **B** potential difference = current × resistance
- **C** power = $(current)^2 \times resistance$
- **D** resistivity = resistance × area ÷ length

25 Diagram 1 is a circuit for a lighting up a lamp installed on a staircase.



During repairs, an electrician mistakenly reverses the connections X_1 and Z_1 , so that Z_1 is connected to the supply and X_1 to the other switch at Z_2 , as shown in diagram 2.



Which switch positions will now light the lamp?

А	X_1 to Y_1	X_2 to Y_2
В	X_1 to Y_1	X_2 to Z_2
С	X_1 to Z_1	X ₂ to Y ₂
D	X_1 to Z_1	X_2 to Z_2

26 The circuit diagram shows a variable resistor connected in parallel to the lower half of a potential divider consisting of two resistors. All three resistors have the same resistance.



The resistance of the variable resistor is now increase.

What happens to the two voltmeter readings?

	<i>V</i> ₁	V ₂
Α	decreases	decreases
В	decreases	increases
С	increases	decreases
D	increases	increases

27 In the circuit shown, the temperature of the room and the amount of light affect the current.



Under which conditions is the current in the circuit the largest?

	Temperature	Amount of light		
Α	High	In bright light		
В	High	In the dark		
С	Low	In bright light		
D	Low	In the dark		

28 An electrical appliance is plugged into a socket in the wall. The plug contains a fuse.

What is the main purpose of the fuse?

- **A** to earth the appliance
- **B** to earth the plug
- **C** to protect the user from electric shock
- **D** to protect the wiring from overheating

29 A positively-charged plastic rod is placed just above a thick metal plate. The metal plate rests on an insulator and is connected to the earth by a wire.



A student disconnects the earthing wire and then removes the positively charged rod. The experiment is repeated. This time the student removes the positively charged rod and then removes the earthing wire.

Which statement is correct?

- A When the earthing wire is disconnected first, the metal plate becomes positively charged.
- **B** When the earthing wire is disconnected first, the metal plate becomes negatively charged.
- **C** When the plastic rod is removed first, the metal plate becomes positively charged.
- **D** When the plastic rod is removed first, the metal plate becomes negatively charged.
- **30** A positively charged insulated metal sphere is brought close to an uncharged insulated metal sphere.



Which diagram shows the charge distribution on the spheres?



31 Which diagram represents the electric field line pattern due to a combination of two positive charges?



32 Each diagram shows a cross-section through two parallel conductors, each carrying an electric current.

In the conductor on the left, the current is into the page; on the right, it is out of the page.

Which diagram shows the directions of the forces on the two conductors?



33 Two medical examinations P and Q carried out in hospitals use different types of waves. The pictures, X and Y, obtained from these two examinations are also shown







Picture X



Medical examination Q



Picture Y

Which combination used in these two medical examinations is correct ?

	Medical Examination	Picture	Wave used in column 1	Medical Examination	Picture	Wave used in column 4
A	Ρ	Y	X-rays	Q	х	Ultra-sound
в	Р	х	infra-sound	Q	Y	Microwave
с	Q	х	X-rays	Р	Y	Gamma- rays
D	Q	Y	Ultra-sound	Р	х	X-rays

34 A loudspeaker and a microphone are placed in front of a wall.



The loudspeaker makes a sound which is detected by the microphone.

The microphone is connected to an oscilloscope which is set so that each division on the screen represents 0.01 s. The microphone detects the original sound and the echo.



display on oscilloscope

The speed of sound in air is 300 m / s.

What is the distance between the loudspeaker and the wall?

- **A** 6.0 m
- **B** 12 m
- **C** 24 m
- **D** 48 m

- 35 Which statement about a water wave is correct?
 - **A** The amplitude is the vertical distance between a trough and a peak.
 - **B** The frequency is the number of troughs passing a point in one second added to the number of peaks passing a point in one second.
 - **C** The speed is the horizontal distance travelled per second by a peak.
 - **D** The wavelength is the horizontal distance between a trough and a peak
- **36** The diagram illustrates the position of particles of a sound wave at one instant in time.



The speed of the wave is *V*. P and Q are two points in the wave a distance *L* apart. What is an expression for the frequency of the wave?

- **A** V/2L
- **B** *V*/*L*
- **C** 2V/L
- **D** *L* / *V*

37 An electric current in a wire is into the page. Which diagram shows the shape and direction of the magnetic field around the wire?



38 A negatively-charged particle enters a uniform field.Which diagram represents the path of the particle in the magnetic field ?



field in plane of paper

В



C field into paper



D field into paper



39 The diagram shows a transformer which is assumed to be 100% efficient. The ratio of the secondary turns to the primary turns is 1: 20.



A 240 V a.c. supply is connected to the $\,$ primary coil and a 6.0 $\,\Omega$ resistor is connected to the secondary coil.

What is the current in the primary coil ?

- **A** 0.10 A
- **B** 0.14 A
- **C** 2.0 A
- **D** 40 A

40 The graph shows the output of an a.c. generator. The coil in the generator rotates 20 times in one second.



The speed of rotation of the coil steadily increases.

Which graph best shows how the output changes



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