Class	Register Number	Name

南洋女子中學校

Nanyang Girls' High School

End-of-Year Examination 2021
Secondary 4

PHYSICS

Paper 1 Multiple Choice

45 minutes

Thursday 7 October **0845 – 0930**

No Additional Materials are required

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

Write your name, register number and class on the Question Paper and on the Answer Sheet in the spaces provided.

There are **thirty** questions on 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** in the spaces provided 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 the acceleration due to gravity g (or gravitational field strength) to be 10 m s^{-2} (or 10 N kg^{-1}) near the Earth's surface.

This document consists of **12** printed pages.

1 Which list of physical quantities contains only vectors?

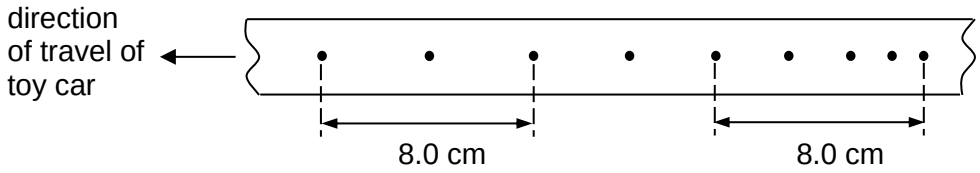
A mass, speed, time

B weight, velocity, friction

C weight, acceleration, temperature

D temperature, time, weight

2 A ticker-tape timer is used to investigate the movement of a toy car. The frequency of the timer is 50 Hz and a portion of the tape is shown below.



What is the average deceleration of the toy car?

A 0.0 m s^{-2} **B** 6.3 m s^{-2}

C 10.0 m s^{-2} **D** 25.0 m s^{-2}

3 A car is initially moving with negative velocity and maintains a constant negative acceleration. Which statement must be true?

A The car will change direction during its motion.

B The car is slowing down.

C The displacement of the car is increasing.

D The speed of the car is increasing.

4 A ball is thrown vertically upwards at time t = 0 s. It passes a window, on its way up, at time t = 1.2 s. It passes the same window, on the way back down, at time t = 2.0 s.

What was the initial speed of the thrown ball?

A 8.0 m s^{-1} **B** 12 m s^{-1}

C 16 m s^{-1} **D** 20 m s^{-1}

5 The SpaceX rocket has a launch mass of 550 000 kg. It is powered by rocket engines which produce a total thrust of 7.6 MN.

What will be the acceleration of the rocket at lift-off?

A 0.0 m s^{-2} **B** 3.8 m s^{-2}

C 38 m s^{-2} **D** 380 m s^{-2}

6 If you are to go to the moon, which of your following physical quantities will change?

(i) Weight

(ii) Mass

(iii) Density

A (i) only

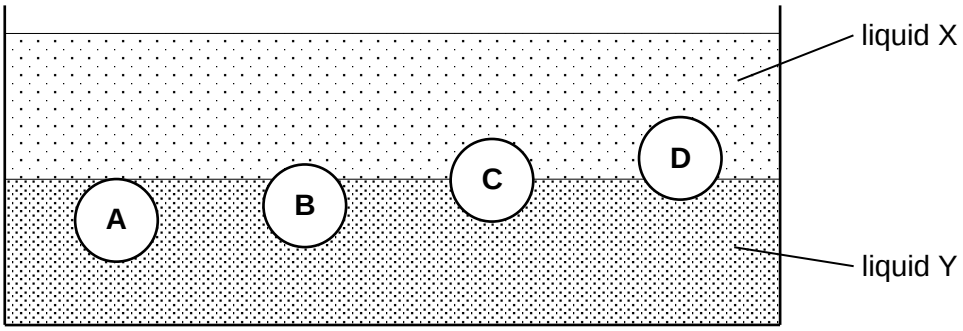
B (i) and (ii) only

C (i) and (iii) only

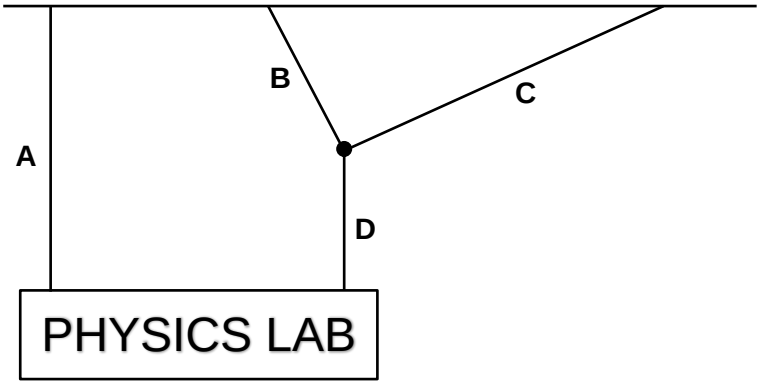
D (ii) and (iii) only

7 A sphere of density 2.5 g cm^{-3} finds an equilibrium position between liquid X of density 1.0 g cm^{-3} and liquid Y of density 3.0 g cm^{-3}.

Which of the following represents this sphere?

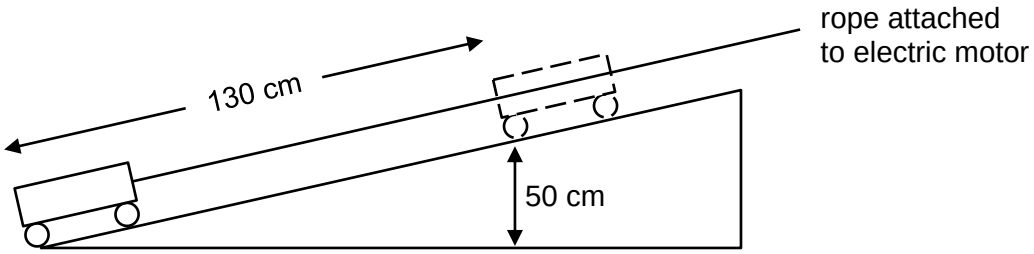


8 A uniform sign is supported by wires A, B, C and D as shown in the diagram below.



Which wire has the smallest tension?

9 A rope attached to an electric motor pulls a 2.0 kg toy car up a smooth ramp such that the toy car moves 130 cm along the slope and gains 50 cm in height as shown.

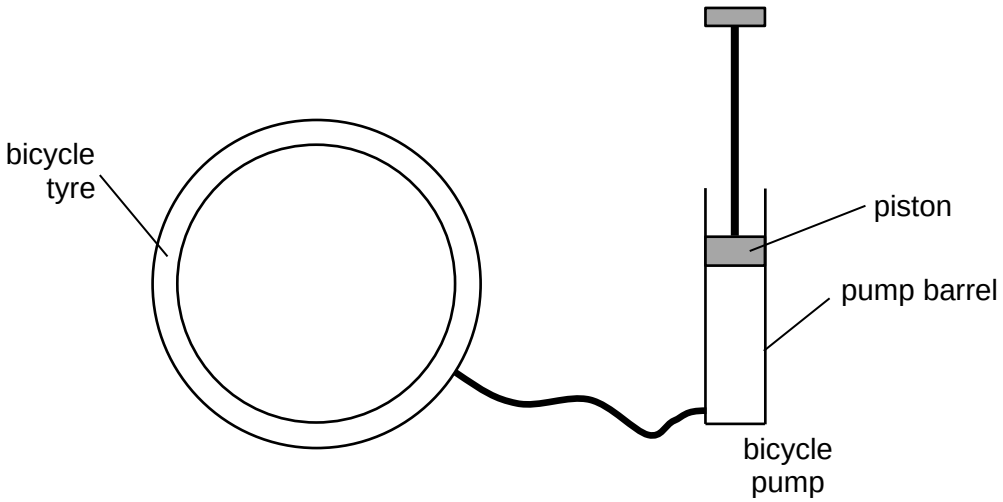


Assuming the toy car starts from rest and has a velocity of 200 cm s^{-1} at the top of the slope, what is total gain in energy of the car?

A 26 J **B** 14 J

C 10 J **D** 4.0 J

10 A bicycle tyre should maintain a minimum pressure of 200 kPa. When checked, the pressure of a tyre was found to be only 150 kPa.



A bicycle pump is used to inflate the tyre. One complete stroke of the piston of the bicycle pump forces 175 cm^3 of air at atmospheric pressure into the tyre.

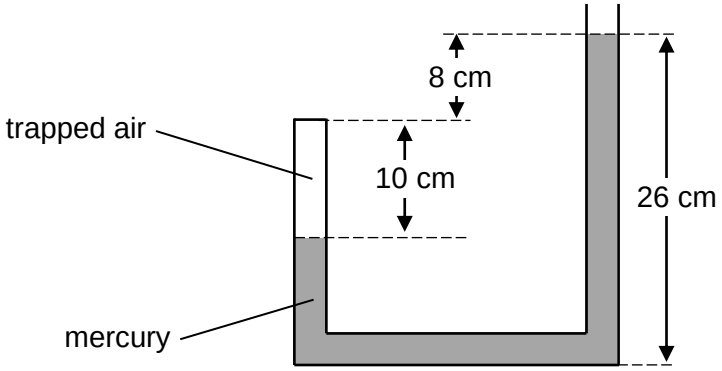
The atmospheric pressure is 100 kPa and the volume of the tyre remains fixed at 2000 cm^3.

What is the minimum number of strokes required to inflate the tyre pressure to at least 200 kPa?

A 6 **B** 5

C 4 **D** 3

11 A J-tube, sealed at one end, has a 10 cm column of air trapped by a mercury thread as shown below.



Given that atmospheric pressure is 76 cm Hg, what is the pressure of the trapped air?

A 18 cm Hg **B** 58 cm Hg

C 84 cm Hg **D** 94 cm Hg

12 Which statement about the image formed by a plane mirror is **incorrect**?

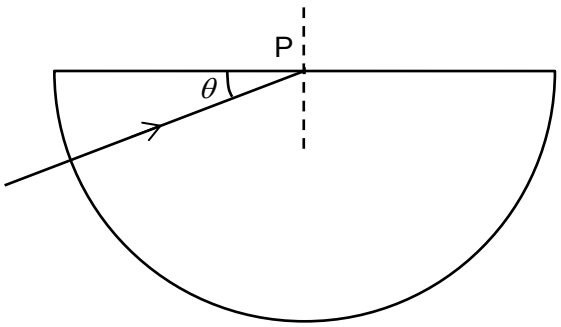
A Light rays travel from the image to our eyes.

B The image cannot be projected on a screen.

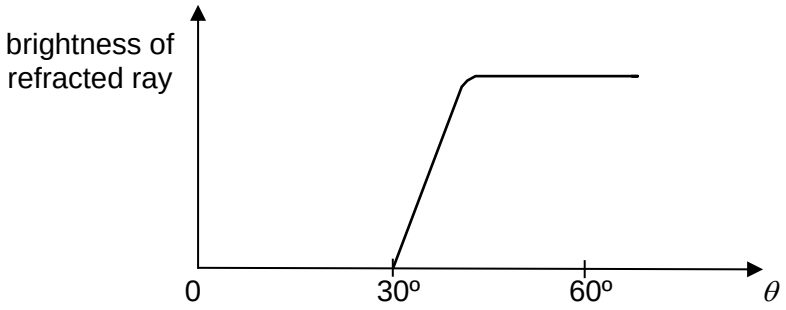
C The image is as far away from the mirror as the object is in front.

D The size of the image is the same as the size of the object, no matter how far the object is placed from the mirror.

13 A light ray enters a semi-circular prism as shown in the diagram.



As θ is changed, the brightness of the refracted ray emerging through point P of the prism is measured and shown on the graph below.



Which row correctly describes the critical angle and the refractive index of the prism?

	critical angle	refractive index
A	30°	2.0
B	30°	0.50
C	60°	0.50
D	60°	1.2

14 Which of the following electromagnetic waves has the highest frequency?

A microwaves **B** radio waves

C red light **D** violet light

15 Ultrasound can penetrate tissue to a depth of approximately 200 times its wavelength.

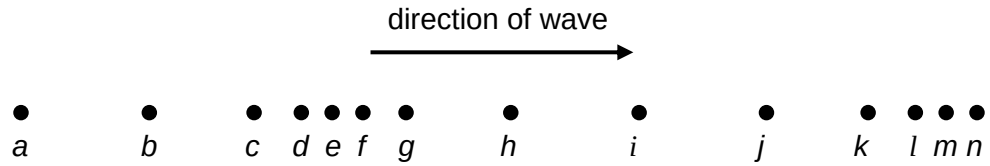
Ultrasound has a speed of 1540 m s^{-1} in human tissue.

What is the approximate depth of penetration of ultrasound at a frequency of 5.0 MHz?

A 0.29 mm **B** 1.4 cm

C 6.2 cm **D** 17 cm

16 A longitudinal wave travels towards the right in air. The diagram shows the positions of a series of air particles at a certain instant in time.



Which statement(s) is/are true?

(1) Particle *e* is at the centre of rarefaction.

(2) Particles *e* and *m* are vibrating in phase.

(3) All particles have the same amplitude.

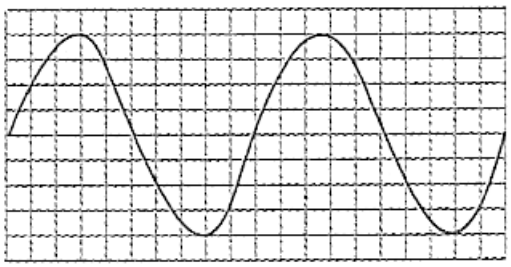
A (1) and (2) only.

B (1) and (3) only.

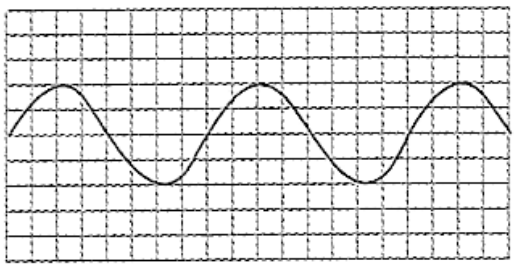
C (2) and (3) only.

D (1), (2) and (3).

17 A microphone and a cathode-ray oscilloscope (c.r.o.) are used to detect the sound emitted by two tuning forks X and Y in turn. The diagrams show the traces obtained for X and Y, with the same settings of the c.r.o.



trace for X



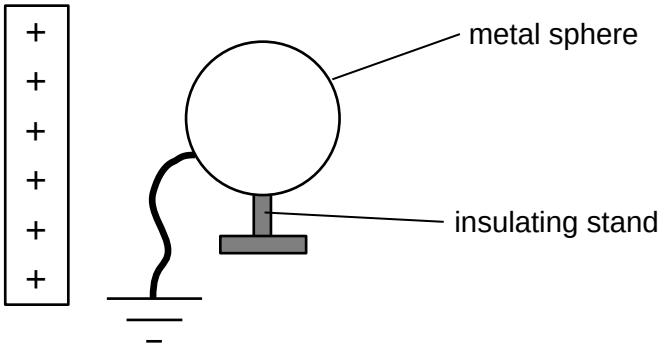
trace for Y

What is the ratio of the frequencies of the sounds emitted by X to that of Y?

A 1 : 2 **B** 2 : 1

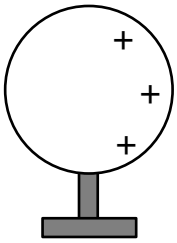
C 4 : 5 **D** 5 : 4

18 A neutral metal sphere is placed near a positively charged rod as shown.

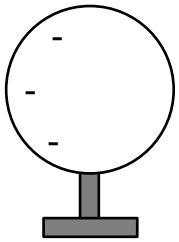


What will be the distribution of charges on the sphere if it is earthed by connecting a wire from the sphere to the earth?

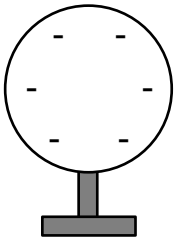
A



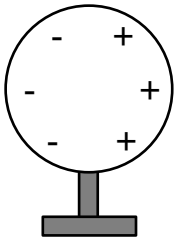
B



C



D



19 A light bulb is rated 12 V, 200 mW.

What quantity of charge flows through this light bulb in 30 minutes when it is operating normally?

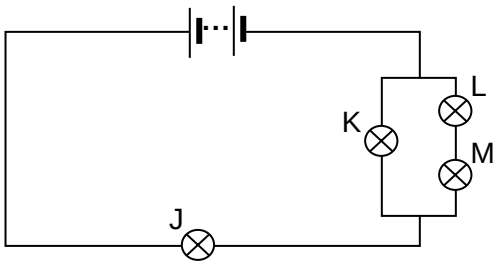
A 2 mC

B 30 mC

C 2 C

D 30 C

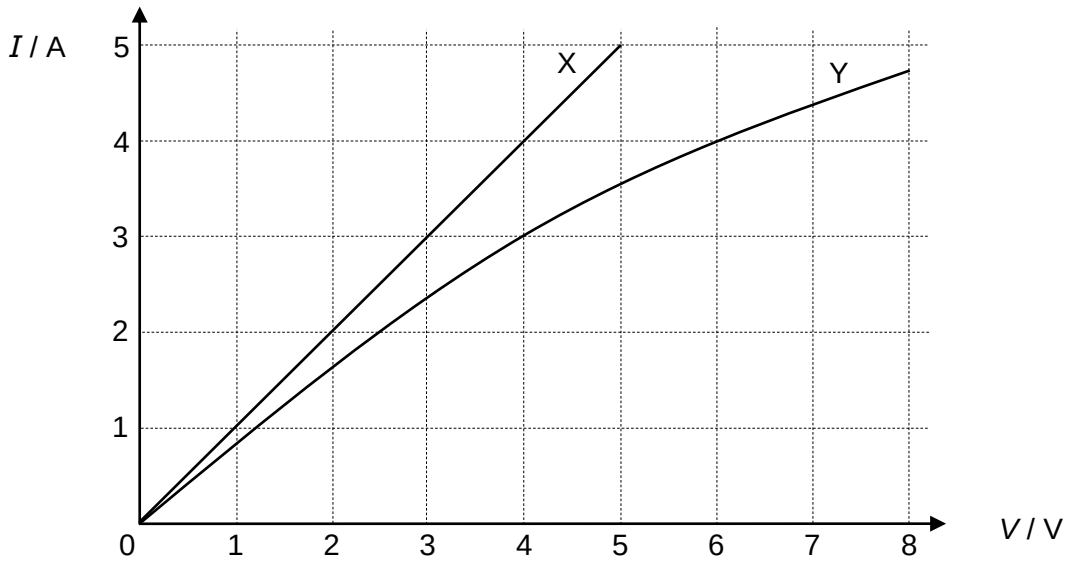
20 Four identical light bulbs, J, K, L and M, are connected in a circuit as shown below.



Which row shows the brightness of the light bulbs in the correct order from the dimmest to the brightest?

	Dimmest	⟶	**Brightest**
A	K	M	J
B	M	K	J
C	J	M	K
D	J	K	M

21 The diagram below shows the current-voltage (*I*-*V*) graph of electric components X and Y.



Which statement is correct when X and Y are connected across a 4.0 V battery?

A When X and Y are connected in series, the current drawn from the battery is 3.5 A.

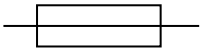
B When X and Y are connected in parallel, the current drawn from the battery is 3.5 A.

C When X and Y are connected in series, the current drawn from the battery is 7.0 A.

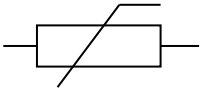
D When X and Y are connected in parallel, the current drawn from the battery is 7.0 A.

22 Which of the following circuit components is not a type of resistor?

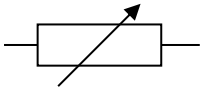
A



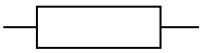
B



C



D



23 When using 3-core wiring (live, neutral and earth wires), where should the fuse be fitted?

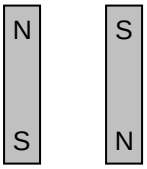
A Only along the neutral wire

B Only along the live wire

C Only along the earth wire

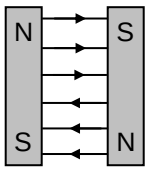
D Along either the live or the neutral wire

24 The diagram shows two bar magnets with unlike poles facing each other.

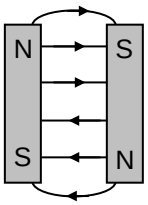


Which diagram shows the magnetic field pattern between the magnets?

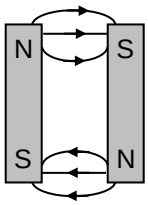
A



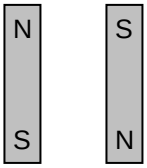
B



C

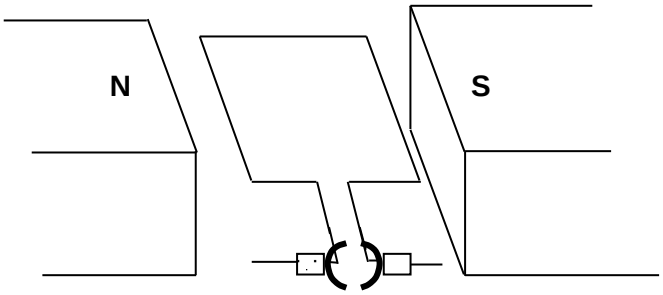


D



no magnetic field between magnets

25 A simple d.c. motor has a flat coil between a pair of magnets as shown below.



Which statement(s) about this simple d.c. motor is/are correct?

(1) The maximum torque on the coil occurs when the plane of the coil is parallel to the magnetic field.

(2) The commutator rotates together with the coil in the magnetic field.

(3) It converts mechanical energy to electrical energy.

A (1) only.

B (2) only.

C (1) and (2) only.

D (1) and (3) only.

26 P, Q and R are three parallel straight wires carrying equal currents flowing out of the paper. R is equidistant from P and Q.

wire R ⊙

wire P ⊙ ⊙ wire Q

What is the direction of the force acting on R?

A → **B** ←

C ↑ **D** ↓

27 What causes Brownian motion of smoke particles?

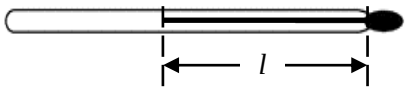
A Collisions between smoke particles.

B Collisions between smoke particles and air molecules.

C Collisions between air molecules.

D Convection currents in the air

28 The length of the mercury thread, l, of a thermometer is measured.



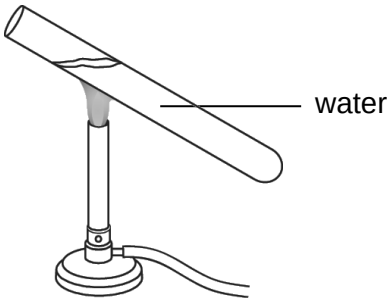
It is 15 mm when the bulb is in melting ice, and it is 165 mm when the bulb is in the steam above boiling water.

If l is 45 mm when the bulb is in liquid X, what is the temperature of liquid X?

A 20 °C **B** 25 °C

C 30 °C **D** 33 °C

29 Water in a test tube is heated with a Bunsen flame as shown below.



Which is the main process involved in transferring heat from the flame to all the water in the test tube?

A convection **B** conduction

C evaporation **D** radiation

30 40 000 J of thermal energy is added to 1.0 kg of ice at -10 °C.

specific heat capacity of ice, = 2090 J $(kg\ K)^{-1}$

specific latent heat of fusion of ice, = $3.34 \times 10^5 J\ kg^{-1}$

What is the mass of ice that melts assuming there is no energy loss to the surroundings?

A 0.011 kg **B** 0.057 kg

C 0.11 kg **D** 1.0 kg

End of paper