TANJONG KATONG GIRLS' SCHOOL
PRELIMINARY EXAMINATION
SECONDARY FOUR EXPRESS

CANDIDATE NAME						
CLASS	4			INDEX NUMBER		

PHYSICS **6091/01**
Paper 1 Multiple Choice **20 August 2024**
1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Write your name, class and index number on the OMR Answer sheet.

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 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.

Take the value of gravitational field strength on Earth, g, to be 10 N / kg unless otherwise stated.

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

Setter : Mr Aloysius Goh
Markers : Mr Aloysius Goh, Ms Sultana, Mr David Chung, Mr Timothy Yeo

This document consists of **19** printed pages and **1** blank page.

Downloaded from SingaKids.com

Section A [40 marks]
Answer **ALL** the questions in this section.

1 What is the approximate mass of an apple?

A 8 g

B 80 g

C 800 g

D 8000 g

2 Which of the following is equivalent to 1.8 g/cm^3?

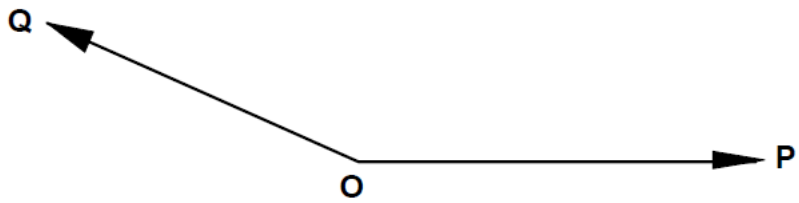
A 1.8 kg/m^3

B 18 kg/m^3

C 180 kg/m^3

D 1800 kg/m^3

3 Forces P and Q act at a point O as shown in the diagram, the angle between their lines of action is varied from 30° to 150°.



If R is their resultant force, which of the following is correct?

A R is always greater in magnitude than either P or Q.

B R is always smaller in magnitude than either P or Q.

C R is never in the same direction as either P or Q.

D The magnitude of R can be equal to the sum of the magnitudes of P and Q.

Downloaded from SingaKids.com

4 A ball is dropped from the top of a 125 m tall building.

What is the time it takes to fall to the ground? Take g to be 10 m/s^2.

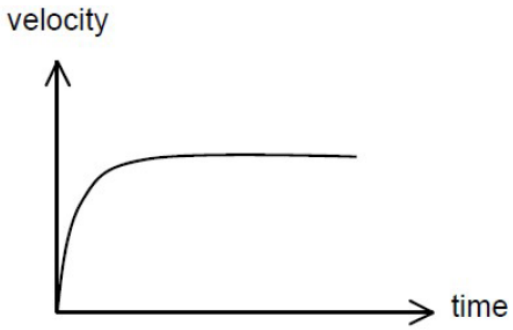
A 0.325 s

B 1.25 s

C 5.00 s

D 10.00 s

5 The velocity time graph of a tennis ball that is dropped from the top of a building is shown below.



Which of the following statements best explains the motion of the ball?

A The air resistance acting on the tennis ball decreases as the tennis ball falls, causing it to accelerate.

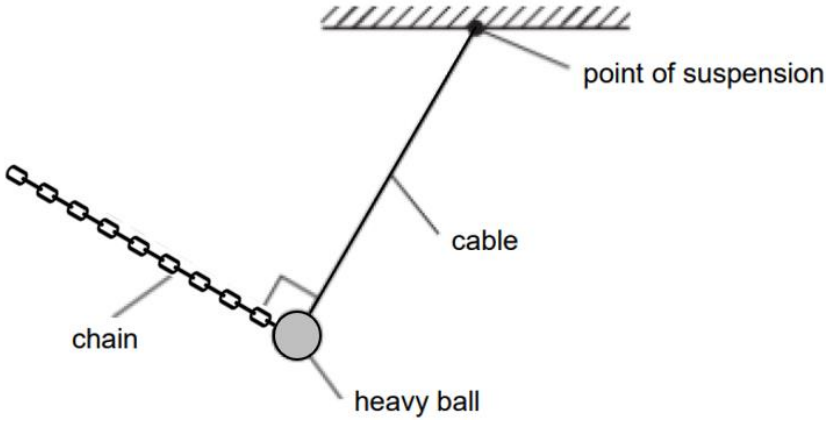
B The air resistance acting on the tennis ball decreases as the tennis ball falls, causing it to decelerate.

C The air resistance acting on the tennis ball increases as the tennis ball decelerates.

D The air resistance acting on the tennis ball increases as the velocity increases until the air resistance is equal to the weight of the tennis ball.

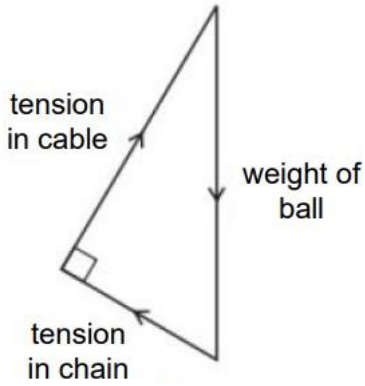
Downloaded from SingaKids.com

6 A heavy ball hanging from a cable is held in equilibrium by a chain.

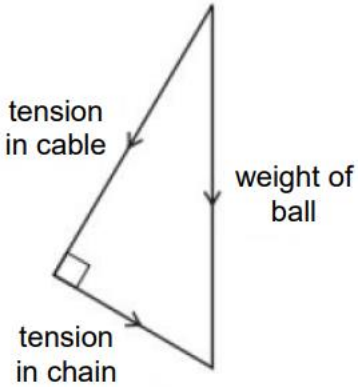


Which vector diagram shows the three forces acting on the ball?

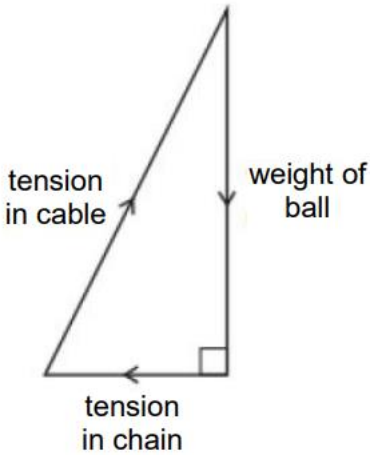
A



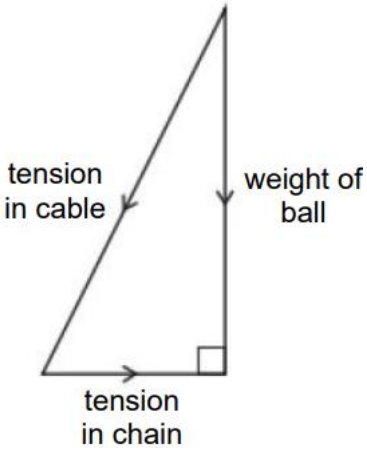
B



C

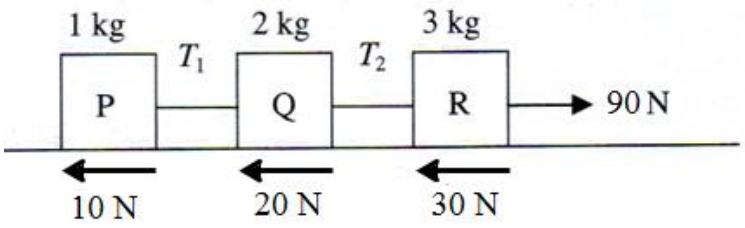


D



Downloaded from SingaKids.com

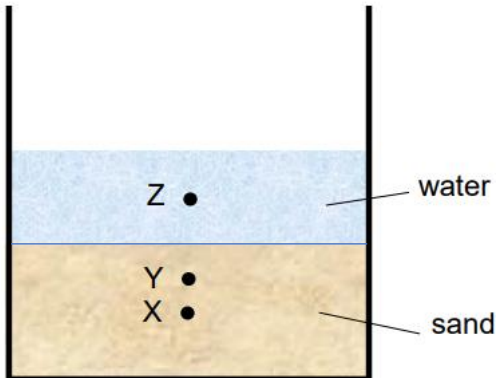
7 P, Q and R are three blocks resting on a rough surface. A force of 90 N is applied at one end as shown in the diagram below.



The masses of P, Q and R are 1 kg, 2 kg and 3 kg respectively and the frictional forces with the floor are 10 N, 20 N and 30 N respectively. What are the tensions T_1, between blocks P and Q, and T_2, between blocks Q and R, in the strings?

	T_1	T_2
A	5 N	10 N
B	15 N	30 N
C	15 N	45 N
D	30 N	30 N

8 The diagram shows a pail containing approximately equal amount of water and sand. X and Z are the centre of gravity of the sand and water respectively



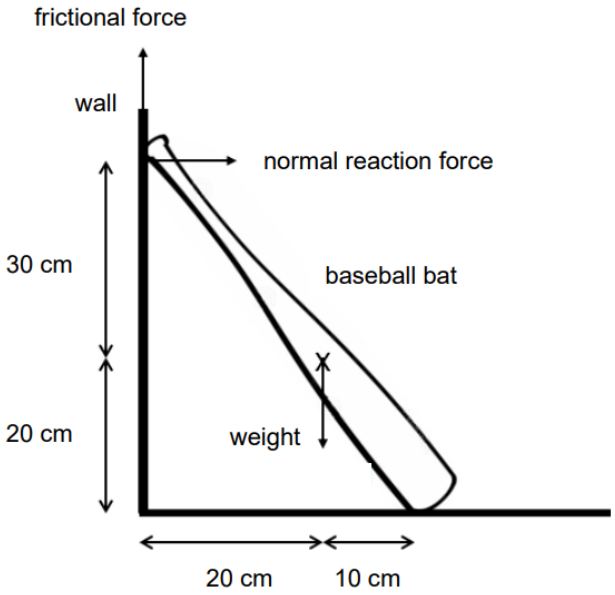
More sand is added to the pail. This affects the position of the centre of gravity of the pail and its contents, and the stability of the pail.

Which of the following shows how the position of the centre of gravity of the pail and its contents, and the stability of the pail will be affected?

	centre of gravity	stability
A	moves from X towards Y	decreases
B	moves from X towards Y	increases
C	moves from Y towards Z	decreases
D	moves from Y towards Z	increases

Downloaded from SingaKids.com

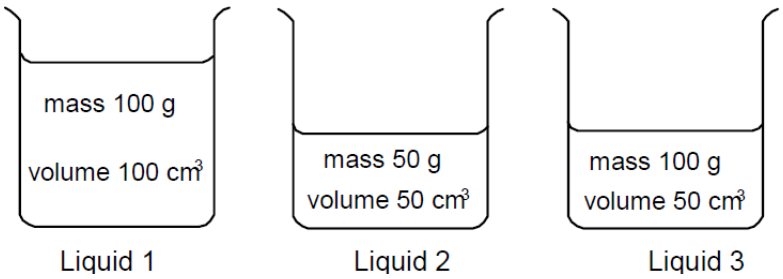
9 A baseball bat is leaning against the wall as shown below. The mass of the baseball bat is 570 g, and the frictional force on the bat by the wall is 0.50 N.



What is the normal reaction force?

A 0.84 N **B** 1.1 N **C** 32 N **D** 42 N

10 Three liquids are poured into beakers as shown.



Which statement about the densities of the liquids is correct?

A Liquid 1 has twice the density of liquid 3.

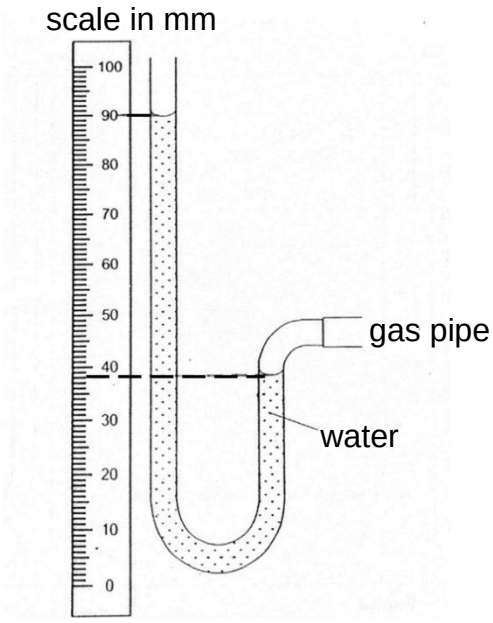
B Liquid 3 has twice the density of liquid 1.

C The liquids all have different densities.

D The liquids all have the same density.

Downloaded from SingaKids.com

11 The diagram below shows a water manometer used to measure the pressure inside a gas pipe. The density of water is 1000 kg m^{-3} and gravitational field strength is 10 N kg^{-1}.



Find the pressure of the gas supply in Pa.

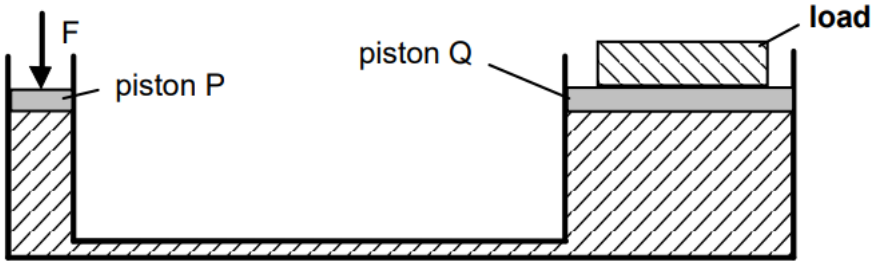
A 380 Pa

B 380 Pa above atmospheric pressure

C 520 Pa

D 520 Pa above atmospheric pressure

12 The diagram shows a hydraulic pump.



Which of the following comparison is true?

A The force F is the same as the weight of the load.

B The force F is greater than the weight of the load.

C The pressure on piston P is the same as the pressure on piston Q.

D The pressure on piston P is smaller than the pressure on piston Q.

Downloaded from SingaKids.com

13 A boy climbs slowly at a steady speed to the top of a small hill.

What is the main energy transfer taking place for the boy as he climbs?

A internal store to kinetic store

B chemical potential store to kinetic store

C kinetic store to gravitational potential store

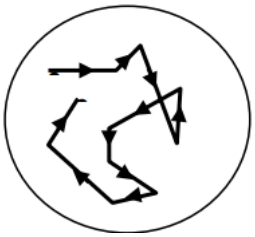
D chemical potential store to gravitational potential store

14 The input power to a motor is 300 W. In 20 s, it lifts a load through a height of 6.0 m. The efficiency of the motor is 60%.

What is the weight of the load?

A 100 N **B** 600 N **C** 900 N **D** 1000 N

15 Smoke particles in a transparent box are observed using a microscope. A small point of light is seen to move around as shown.



What does this experiment demonstrate about air molecules?

A They move because of collisions with smoke particles.

B They can be seen through a microscope.

C They are in continuous random motion.

D They move more quickly when they are heated.

Downloaded from SingaKids.com

16 As air is sucked from a straw out of a sealed packet drink, the packet shrinks in volume.

Which of the following best explains why the packet drink shrinks in volume?

A The collision of air molecules with the internal surface area of packet drink has decreased.

B The kinetic energy of the air molecules in the packet drink has decreased and the frequency of collisions of the air molecules and packet wall has decreased.

C The air molecules are in continuous random motion.

D The air molecules move more quickly when they are heated.

17 A consultant for a cookware manufacturer wishes to make a pan that will have two features:
(i) absorb energy from a flame as quickly as possible, and
(ii) has a cooking surface that stays as hot as possible when heated.

Which pan would be recommended?

A outer and inner surface black

B outer and inner surface shiny

C outer surface shiny and inner surface black

D outer surface black and inner surface shiny

18 A block of gold of mass m has a specific heat capacity of c. A block of copper of mass $2m$ has a specific heat capacity of $3c$. Both metals receive the same quantity of heat and the temperature of the copper rises by 10 °C.

What is the temperature rise of the gold block?

A 15 ^{o}C

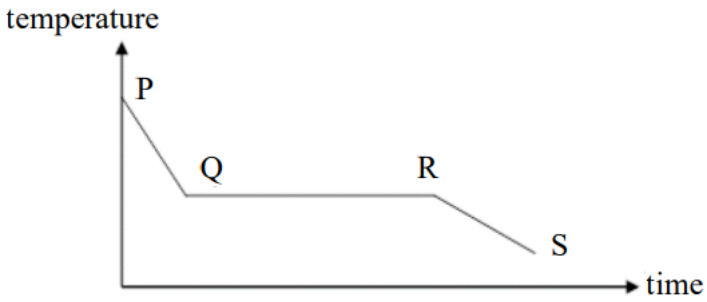
B 20 ^{o}C

C 30 ^{o}C

D 60 ^{o}C

Downloaded from SingaKids.com

19 The graph shows how the temperature of a sample of molten wax changes as it cools.



Which statement is correct?

A From P to Q, the molecules lose internal energy and intermolecular forces of attraction decrease.

B From Q to R, latent heat is given out to the surroundings and intermolecular forces of attraction increase.

C From Q to R, the molecules come closer together and internal energy increases.

D From R to S, latent heat is given out to the surroundings and molecules move more slowly.

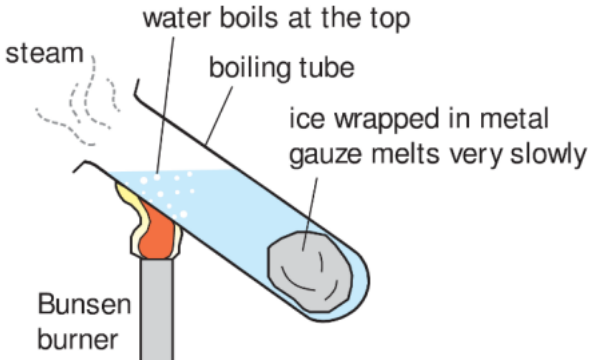
20 A puddle of water on the road evaporates and this causes a change in its temperature.

Which of the following is correct about the temperature change and the reason for the temperature change?

	temperature	reason
A	decreases	less energetic molecules leave the water
B	decreases	more energetic molecules leave the water
C	increases	more energetic molecules leave the water
D	no change	less energetic molecules leave the water

Downloaded from SingaKids.com

21 An experiment is carried out as shown in the diagram.



The ice takes a long time to melt, even though the water at the top of the boiling tube is boiling.

Which statement best explains this?

A Water is a poor conductor of heat.

B Hot water at the bottom of the boiling tube rises to the top.

C Cold water at the top of the boiling tube sinks to the bottom.

D The wire gauze prevents energy transferred by heating from reaching the ice.

22 Which statement about electromagnetic waves is correct?

A Infrared rays are used in sunbeds for artificial sun tanning.

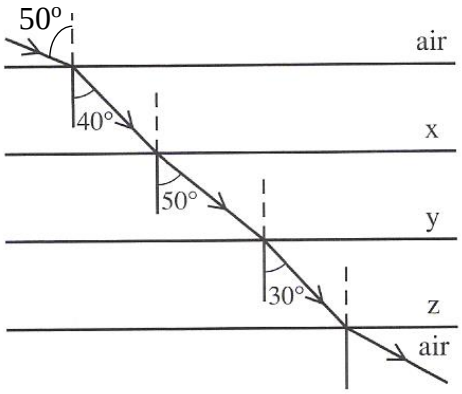
B Microwaves are used in satellite communications.

C Visible light can damage human proteins and DNA.

D X-rays are used to check for counterfeit notes.

Downloaded from SingaKids.com

23 The diagram shows a ray of light passing through three different medium X, Y, and Z. The refractive indices of X, Y, and Z are n_x, n_y,and n_z respectively.



Which one of the following is correct?

A $n_x < n_y$ **B** $n_y > n_z$ **C** $n_z > n_x$ **D** $n_y > n_x > n_z$

24 A ray of light passes from glass to air. In glass, the speed of light is 1.8×10^8 m/s.

What is the critical angle for light passing from glass to air?

A 18° **B** 30° **C** 37° **D** 42°

25 Bats produce ultrasound to navigate. What is the possible frequency range of ultrasound waves?

A 0 Hz to 20 Hz

B 20 Hz to 1200 Hz

C 20 Hz to 20 kHz

D 20 kHz to 120 kHz

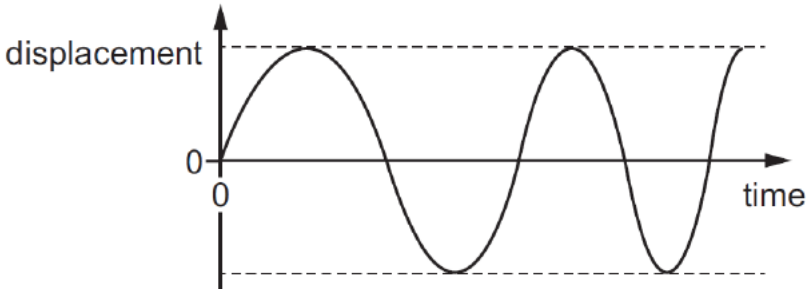
26 The frequency of X-rays used in radiology is 3.0×10^{18} Hz.
Their speed in air is 3.0×10^8 m/s.

What is a possible frequency and a possible wavelength in air of gamma rays?

	frequency / Hz	wavelength / m
A	3.0×10^{16}	1.0×10^{-8}
B	3.0×10^{16}	1.0×10^{8}
C	3.0×10^{20}	1.0×10^{-12}
D	3.0×10^{20}	1.0×10^{12}

Downloaded from SingaKids.com

27 The displacement–time graph for an air particle in the path of a sound wave is shown.



Which property of the sound wave must be increasing?

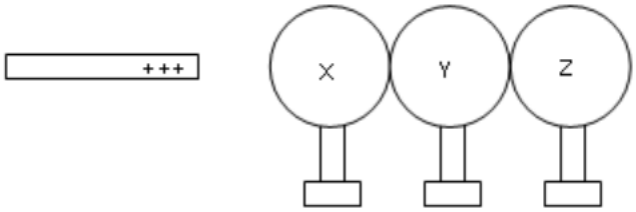
A amplitude

B frequency

C period

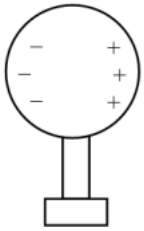
D wavelength

28 Three initially uncharged spheres X, Y and Z are in contact, each supported on an insulating stand. A positively charged rod is placed close to but not touching X.

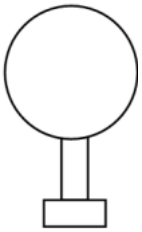


Which of the following best illustrates the distribution of charges on sphere Y?

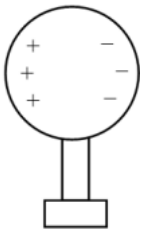
A



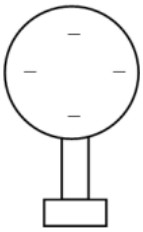
B



C



D



Downloaded from SingaKids.com

29 When a plastic rod is rubbed with a dry cloth, the rod gains electrons from the cloth.

What is the final charge on the rod and on the cloth?

	charge on rod	charge on cloth
A	negative	negative
B	negative	positive
C	positive	negative
D	positive	positive

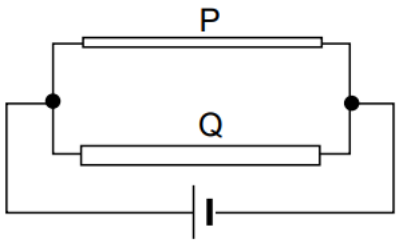
30 When there is a potential difference across a component, W is the total work done to drive the charges through the component and Q is the total charges passing through the component in time t.

What is the potential difference across the component?

A Q / W **B** Qt / W **C** W / Q **D** W / Qt

31 The diagram shows two wires P and Q, each of the same length and the same material, connected in parallel to a battery.

The cross-sectional area of Q is twice that of P.

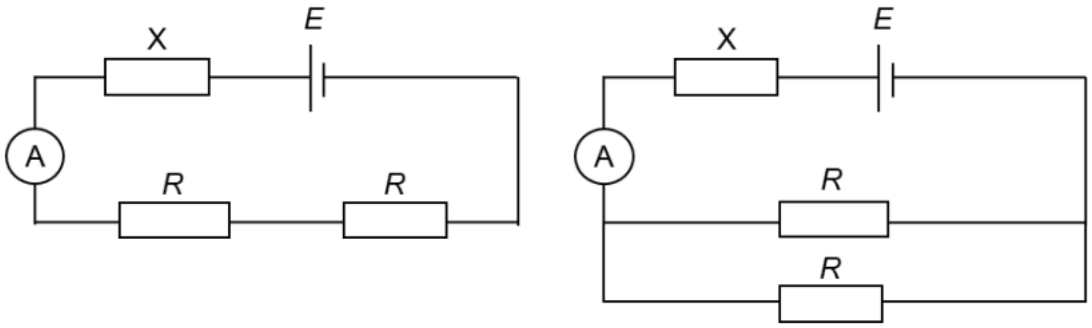


What fraction of the total current passes through P?

A $\frac{1}{5}$ **B** $\frac{1}{4}$ **C** $\frac{1}{3}$ **D** $\frac{1}{2}$

Downloaded from SingaKids.com

32 Two resistors, each of resistance *R*, are connected in series and then in parallel with the d.c. supply of electromotive force (e.m.f.) *E* and resistor X.



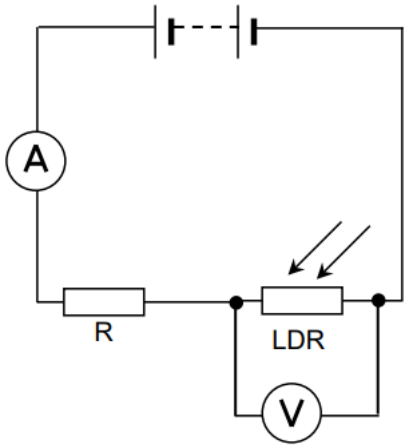
circuit 1 circuit 2

The ammeter reading in circuit 2 is three times the ammeter reading in circuit 1.

What is the resistance of X?

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

33 The diagram shows a potential divider circuit comprising a power source, a light-dependent resistor (LDR), a fixed resistor (R), a voltmeter and an ammeter.



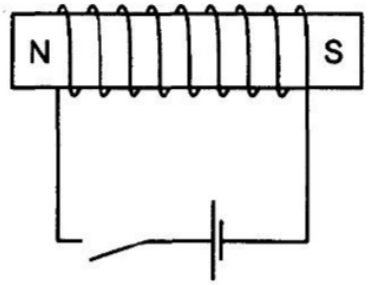
What will happen to the readings on the voltmeter and the ammeter when there is an increase of light intensity?

	voltmeter reading	ammeter reading
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

Downloaded from SingaKids.com

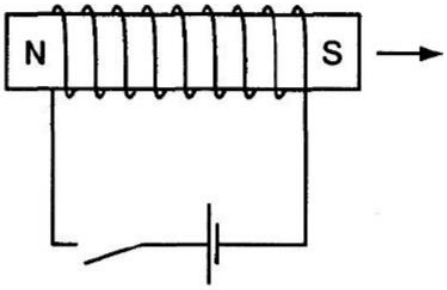
34 Which diagram shows the most effective method of demagnetising a permanent magnet?

A



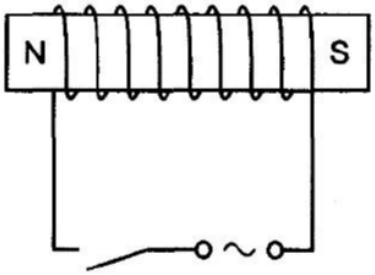
Current switched on then off with the magnet left in place

B



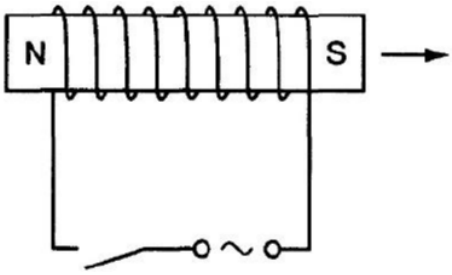
Current switched on then the magnet is withdrawn

C



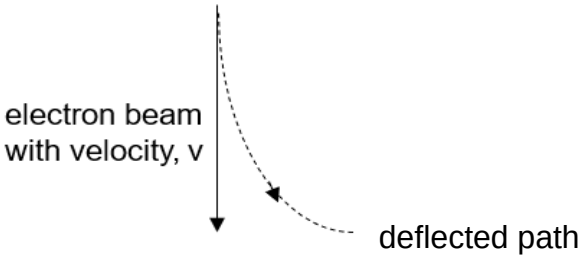
Current switched on then off with the magnet left in place

D



Current switched on then the magnet is withdrawn

35 A beam of electrons moves in a straight path through a magnetic field with an initial velocity, v. The electrons are deflected as shown.



What is the direction of the magnetic field?

A into the paper

B out of the paper

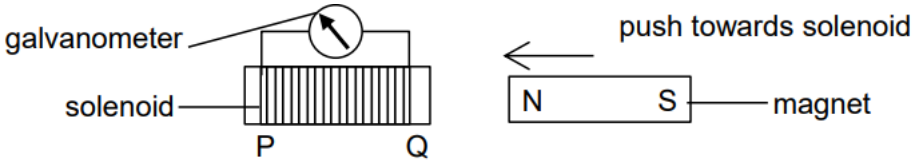
C to the left

D to the right

Downloaded from SingaKids.com

36 A student pushes the N-pole of a bar magnet into end Q of a long solenoid.

An electromotive force and hence an induced current is induced in the solenoid and the galvanometer needle deflects to the left as shown.



Which of the following produces a deflection in the same direction?

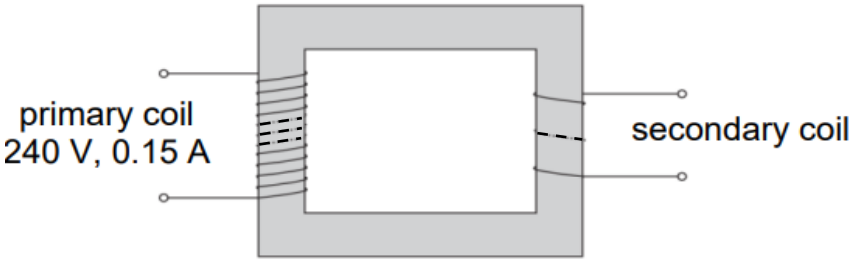
A pulling the N-pole out of end Q

B pulling the S-pole out of end P

C pushing the N-pole into end P

D pushing the S-pole into end P

37 An ideal step-down transformer has an input voltage of 240 V and an input current of 0.15 A in the primary coil. The dotted lines represent an x-number of turns and y-number of turns in the primary coil and secondary coil respectively not shown in the diagram.



Under these conditions, what output voltage and output current could be obtained in the secondary coil? (**Note:** do not count the number of turns in the diagram)

	output voltage / V	output current / A
A	50	0.36
B	180	0.20
C	360	0.10
D	700	0.05

Downloaded from SingaKids.com

38 The half-life of a certain radioactive element is such that $\frac{7}{8}$ of a given quantity decays in 12 days.

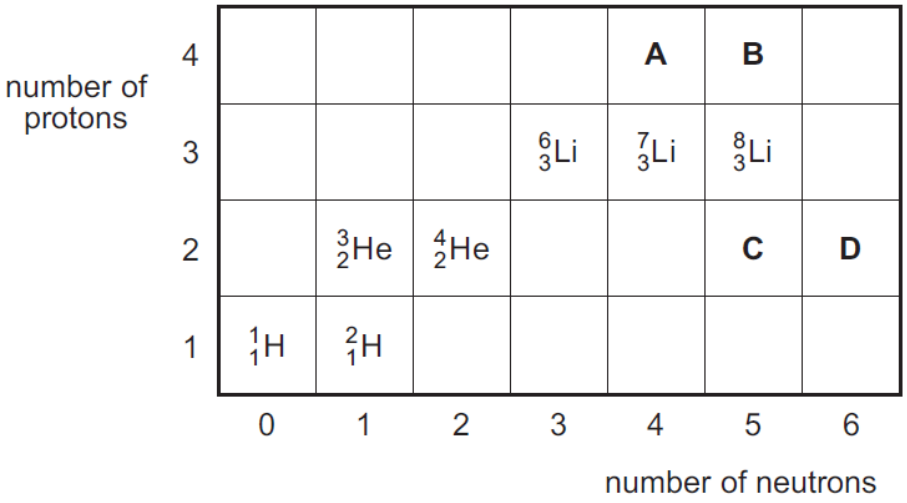
What fraction remains undecayed after 24 days?

A $\frac{1}{128}$ **B** $\frac{1}{64}$ **C** $\frac{1}{32}$ **D** $\frac{1}{16}$

39 The grid shows some nuclides arranged according to the number of protons and the number of neutrons in each of them.

A nucleus of the nuclide $^{8}_{3}Li$ decays by emitting a β-particle.

What is the resulting nuclide?



Downloaded from SingaKids.com

40 Alpha, beta and gamma radiations have various depths of penetration in matter and different charges.

Which row best summarises the penetration and charge of each radiation?

	alpha	beta	gamma
A	absorbed by a sheet of card negative charge	absorbed by several mm of aluminium no charge	not fully absorbed by several cm of lead no charge
B	absorbed by a sheet of card negative charge	absorbed by several mm of aluminium positive charge	not fully absorbed by several cm of lead no charge
C	absorbed by a sheet of card positive charge	absorbed by several mm of aluminium negative charge	not fully absorbed by several cm of lead no charge
D	absorbed by several mm of aluminium positive charge	not fully absorbed by several cm of lead negative charge	absorbed by a sheet of card no charge

Downloaded from SingaKids.com

BLANK PAGE

Downloaded from SingaKids.com

2024 Sec 4 Preliminary Examination Physics
Mark Scheme
Paper 1

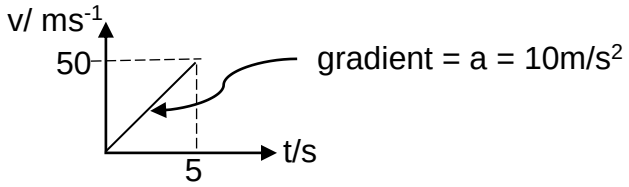
1	2	3	4	5	6	7	8	9	10
B	D	C	C	D	A	C	C	A	B
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
D	C	D	B	C	A	D	D	B	B
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
A	B	C	C	D	C	B	B	B	C
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
C	B	B	D	B	D	B	B	A	C

1 B
Weight of normal sized apple is 70 – 100g

2 D
$1.8\ g/cm^3 = 1.8 \times 10^6\ g / m^3 = 1800\ kg / m^3$

3 C
R is not always smaller or greater than P or Q.
R, which is the vector sum of P and Q, cannot be in the same direction as P or Q, given that angle between P and Q is 30^o to 150^o

4 C



displacement = ½ x 5 x 50 = 125 m

5 D
Velocity stops increasing and acceleration is zero when air resistance is equal to weight of object

6 A

7 C
90 – 60 = (6) x (a)
$a = 5m/s^2$
P: $T_1 – 10 = (1) \times (5)$
$T_1 = 15\ N$
Q: $T_2 – T_1 – 20 = (2) \times (5)$
$T_2 = 45\ N$

8 C
Initial overall CG should be higher than X. When volume of sand increases, overall CG should move upwards (since there is now more sand at the higher levels). Since CG rises, stability decreases.

Downloaded from SingaKids.com

9 A
ACW = CW
0.57 X 10 X 10 = (0.5 X 30) + (F_N X 50)
50 F_N = 42
F_N = 0.84 N

10 B

11 D
$P_{gas} – P_{atm}$ = hρg = 520 Pa

12 C
Force F is not equal to weight of load.
Pressure throughout the liquid is the same according to Pascal principal

13 D
Since same speed, KE remains the same
Chemical potential store from muscles convert to gravitational potential store

14 B
Output power = mgh/20 = 0.6 x 300 W = 180 W
W = mg = (180 x 20) / 6 = 600 N

15 C
The bends represent the change in direction of the illuminated smoke particles when they are hit by the air molecules from all directions with different magnitude. This shows that air molecules are in continuous random motion

16 A
Less air molecules left in the packet colliding with a smaller surface area. Pressure inside the packet decreases and packet shrinks.

17 D
Black surface are better absorbers of energy through heating and shiny surface are better reflectors / retainers of energy through heating.

18 D
gold: Q = mcΔθ_1
copper: Q = 2m x 3c x Δθ_2
mcΔθ_1 = 6 mc Δθ_2
Δθ_1 = 60 ^oC

19 B
When latent heat is lost, molten wax changes from liquid to solid.

20 B
Evaporation causes cooling when the most energetic molecules leave the water.

Downloaded from SingaKids.com

21 A
Heat cannot be conducted quickly via water to reach the ice.

22 B
(uses of different types of EM waves)

23 C
$n_x = \sin 50^o / \sin 40^o$
$n_y = \sin 40^o / \sin 50^o$
$n_z = \sin 50^o / \sin 30^o$

$n_z > n_x$

24 C
$n = c/ v = (3 \times 10^8) / (1.8 \times 10^8) = 1.67$
$n = 1/ \sin c$
$1.67 = 1/ \sin c$
$c = 37^o$

25 D
Frequency of ultrasound is beyond human audible range.

26 C
Gamma rays has higher frequency than X-rays. Taking frequency to be 3.0×10^{20}, $\lambda = 3.0 \times 10^8 / 3.0 \times 10^{20} = 1.0 \times 10^{-12}$ m

27 B
Period decreases as shown from the graph.
$f = 1 / T$
therefore frequency increases.

28 B
Negative charges are induced to the side of sphere X near to the charged rod and the far side in sphere Z with a deficit of negative charges will be positively charged.

29 B
Rod gains electrons and becomes negatively charged. Cloth loses electrons and becomes positively charged

30 C
$W = QV$

31 C
$R_Q = R/2$, $R_P = R$
$I_P = 1/3\ I$

32 B
$I_2 = 3\ I_1$
$R_2 = R_1 / 3$
$R_1 = 2R + X$

Downloaded from SingaKids.com

33 B

When light intensity increases, R_{LDR} decreases.
By potential divider rule, V_{LDR} decreases too. Since overall resistance decreases, current and thus ammeter reading increases.

34 D

To demagnetize the magnet, there must be a strong enough changing magnetic field to misalign / de-orientate the magnetic dipoles.
Option D is better than option B because a changing magnetic field is more effective in de-orientating the magnetic dipoles than a constant magnetic field, assuming the strength of the magnetic field is the same.

35 B

Using FLHR. Current is opposite direction to electrons flow.

36 D

By lenz's law, induced current will flow in such a way to produce a north-pole at Q and a south-pole at P.
When the south-pole is pushed into end P, according to Lenz's law, the induced current will flow in the same way as above to produce a south-pole at P.

37 B

Answer can only be A or B since voltage is stepped down.
Based on 240 V and 180 V, the turn ratio is 4:3. Conversely, current is stepped up by inverse of the turn ratio 3:4.

38 B

Since 1/8 of the radioactive sample is left, the sample underwent 3 half lives, $(1/2)^3$. Half life is therefore 4 days.
In 24 days, sample underwent 6 half lives, $(1/2)^6 = 1/64$.

39 A

The resulting nuclide has one more proton and thus one less neutron.

40 C

Characteristics of alpha, beta and gamma radiation

Downloaded from SingaKids.com