NAME:	NO:	CLASS:

ADMIRALTY SECONDARY SCHOOL

PRELIMINARY EXAMINATION 2021

SUBJECT	:	Science (Physics, Chemistry)
CODE/PAPER	:	5076/1
LEVEL/STREAM	:	Secondary 4 Express / Secondary 5 Normal (Academic)
DATE	:	30 August 2021
TIME	:	1120h – 1220h
DURATION	:	1 hour

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, class and register number on the Optical Answer Sheet provided unless this has been done for you.

There are **forty** 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** on the Optical Answer Sheet.

Fill in the Optical 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 question paper.
A copy of the Data Sheet is printed on page 17.
A copy of the Periodic Table is printed on page 18.
The use of an approved scientific calculator is expected, where appropriate.

40

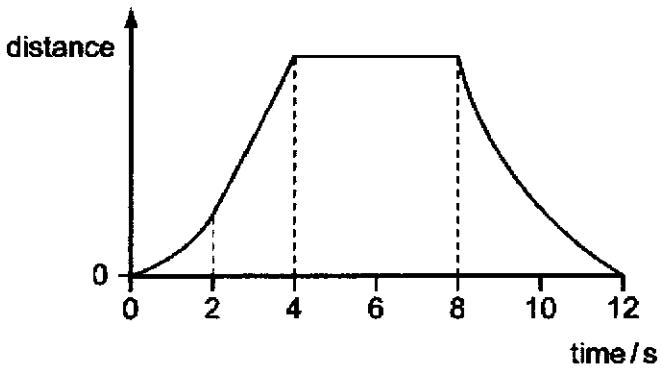
DO NOT TURN OVER THIS PAPER UNTIL YOU ARE TOLD TO DO SO.

This question paper consists of 18 printed pages including this cover page.

1 A plumber measures, as accurately as possible, the length and internal diameter of a straight copper pipe.
The length is approximately 80 cm and the internal diameter is approximately 2 cm.
What is the best combination of instruments for the plumber to use?

	internal diameter	length
A	rule	rule
B	rule	tape
C	vernier calipers	rule
D	vernier calipers	tape

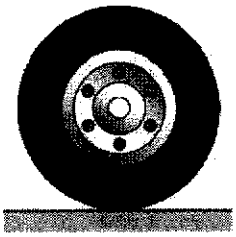
2 The graph shows how the distance of an object changes with time.



Between which two times is the object moving with a non-zero constant speed?

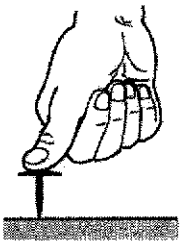
A between 0 s and 2 s
B between 2 s and 4 s
C between 4 s and 8 s
D between 8 s and 12 s

3 The same downward force is applied to four objects resting on a horizontal surface. Which exerts the greatest pressure on the surface?



car wheel

A



drawing pin

B

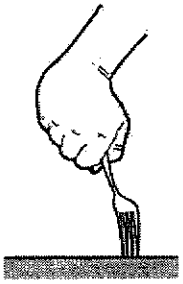


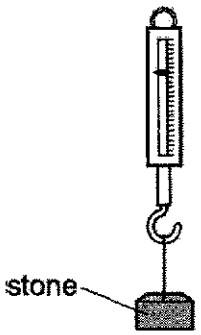
table fork

C

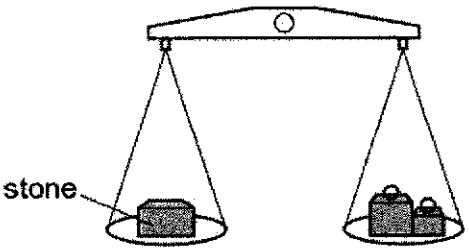
stiletto heel

D

4 The weight of a stone is found using a newton meter, and its mass is found using a pan balance.



newton meter

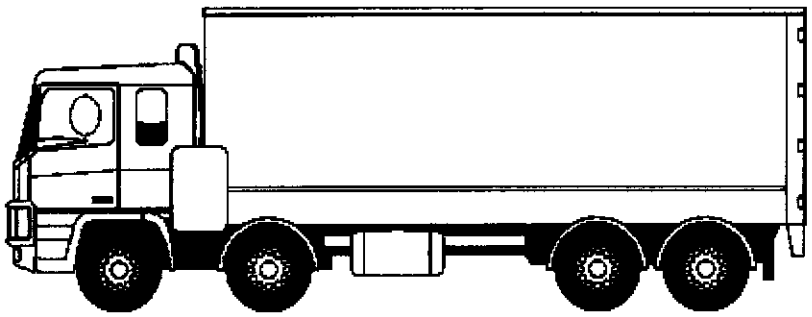


pan balance

The experiment is carried out on the Earth and on the Moon.
For each meter, is its reading the same or different on the Earth and on the Moon?

	reading on newton meter	reading on pan balance
A	different	different
B	different	same
C	same	different
D	same	same

5 The diagram shows a lorry.



What is the best position for its centre of mass and why is it placed there?

	best position	reason for the position
A	as high as possible	the lorry can accelerate more rapidly
B	as high as possible	the lorry is more stable
C	as low as possible	the lorry can accelerate more rapidly
D	as low as possible	the lorry is more stable

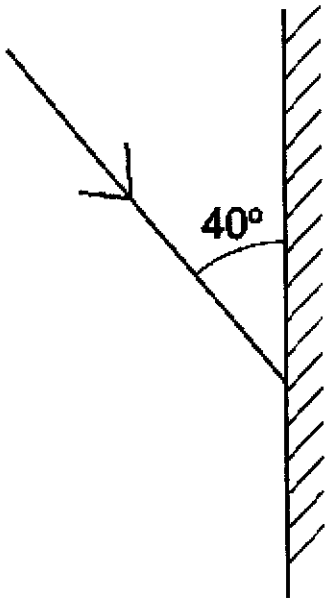
6 A machine does 6.0 kJ of useful work in 20 minutes.
How much useful power does it produce?

A 0.30 W **B** 5.0 W **C** 120 W **D** 300 W

7 What is the property common to both solids and liquids?

A They always fill a container.
B They can flow.
C They have a fixed shape.
D They have a fixed volume.

8 The diagram shows a single ray of light being directed at a plane mirror.



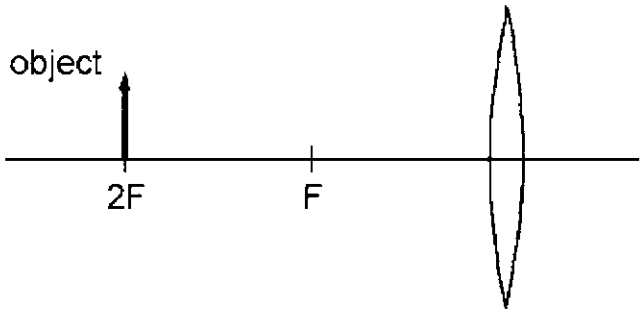
What are the angles of incidence and reflection?

	Angle of incidence	Angle of reflection
A	40 °	40 °
B	40 °	50 °
C	50 °	40 °
D	50 °	50 °

9 Warm water in a bowl evaporates.
Which row shows where the evaporation occurs and what effect the evaporation has on the temperature of the remaining water?

	where evaporation occurs	effect on water temperature
A	only on the surface	decreases
B	only on the surface	unchanged
C	throughout the water	decreases
D	throughout the water	unchanged

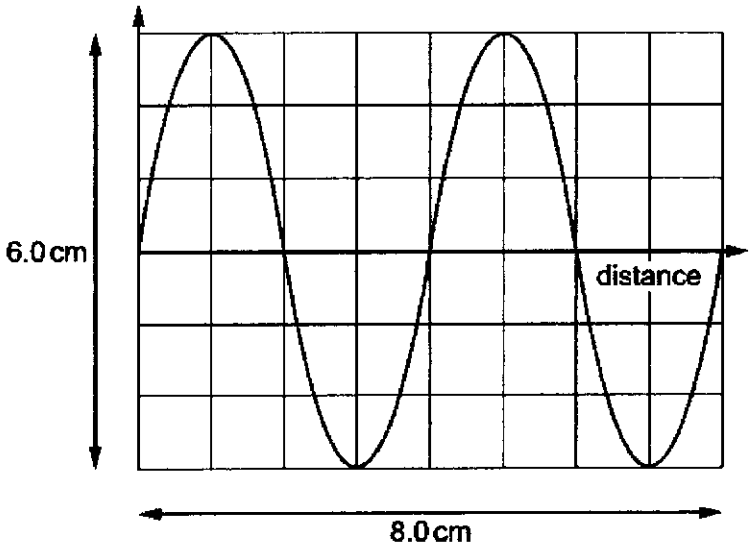
10 The diagram below shows a set-up using a thin converging lens. F is the focal point of the lens.



Which of the following is the correct application for the above set-up?

A magnifying glass
B photocopier
C projector
D telescope

11 The diagram represents a wave.



What is the wavelength of the wave?

A 3.0 cm **B** 4.0 cm **C** 6.0 cm **D** 8.0 cm

12 A radio station transmits signals at a frequency of 9.1×10^7 Hz.
What is the wavelength of the radio waves?

A 0.30 m **B** 0.33 m **C** 3.0 m **D** 3.3 m

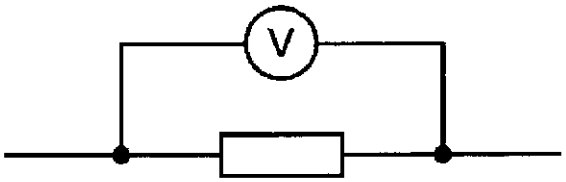
13 An electronic circuit in a fire alarm makes a loudspeaker vibrate alternately at two different frequencies.
Which pair of frequencies is suitable for use in the alarm to alert people to the danger of fire?

A 1.5Hz and 15Hz
B 15Hz and 150 000Hz
C 150Hz and 15 000Hz
D 150000Hz and 15000000Hz

14 The metal case of an electric heater is earthed. The plug to the heater contains a 5 A fuse. There is a current of 4 A when the heater works normally.
The cable to the heater becomes so worn out that the live wire makes electrical contact with the case.
What can possibly happen?

A The current flows to earth and the fuse is not affected.
B The fuse melts and switches off the circuit.
C The metal case becomes live and dangerous.
D The metal case becomes very hot.

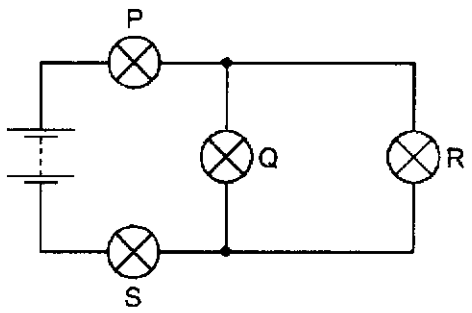
15 A voltmeter is connected across a resistor in an electrical circuit.



What does the reading on the voltmeter measure?

A the work done in driving 1A of current through the resistor
B the work done in driving 1C of charge through the resistor
C the work done in driving 1J of energy through the resistor
D the work done in driving 1W of power through the resistor

16 The diagram shows a circuit with four identical bulbs P, Q, R and S.



Which statement about the brightness of the bulbs is correct?

A P is the same brightness as Q.
B P is the same brightness as S.
C Q is brighter than S.
D R is brighter than P.

17 A 240V mains supply causes a current of 4.00 A in a heater.
How much energy is transferred in the heater in 5 minutes?

A 192 J **B** 4800 J **C** 18 000 J **D** 288 000 J

18 Why is the electricity supply to a house fitted with a fuse?

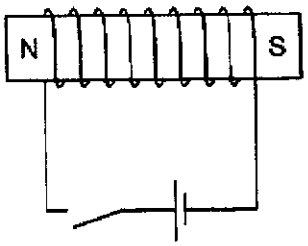
A to increase the current in the circuit
B to increase the resistance of the circuit
C to maintain a constant current in the circuit
D to prevent overheating of the cables in the circuit

19 A person uses a 3kW electric fire for 2 hours and a 2kW heater for 4 hours.
What is the total cost if the price of electrical energy is 5.0 cents per unit?

A 70 cents **B** 60 cents **C** 40 cents **D** 30 cents

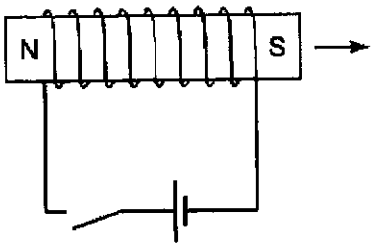
20 A permanent magnet can be demagnetised by using a solenoid and switching the current on then off.
Which diagram shows the most effective method of producing demagnetisation?

A



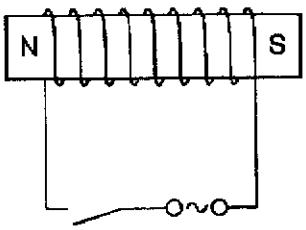
magnet left in place

B



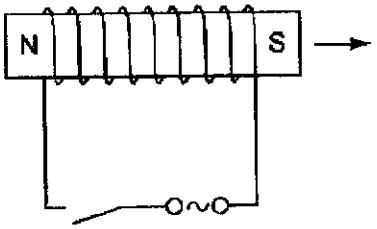
magnet withdrawn before switching off

C



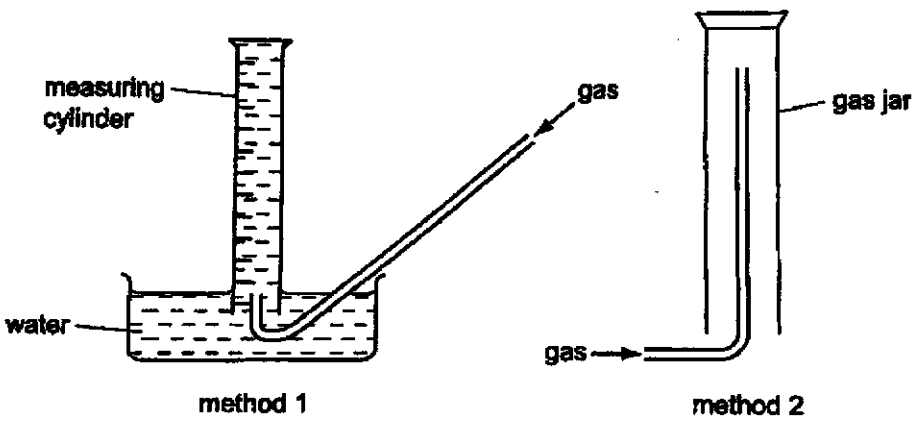
magnet left in place

D



magnet withdrawn before switching off

21 The diagrams show two methods of collecting gases.



Which row gives the property of a gas that can be collected by both methods?

	property 1	property 2
A	insoluble in water	denser than air
B	insoluble in water	less dense than air
C	soluble in water	denser than air
D	soluble in water	less dense than air

22 A solid was thought to be copper(II) carbonate.

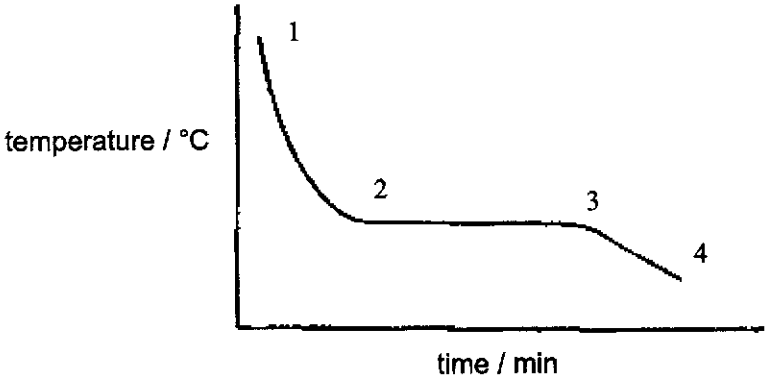
Which of the following is the best way to test the purity of this solid?

A Measure its melting point.
B Measure the pH of its solution.
C Add dilute hydrochloric acid and test for carbon dioxide gas.
D Conduct thermal decomposition and test for carbon dioxide gas.

23 Which of the following consists of mixture(s) and element(s)?

A copper(II) sulfate, francium, lithium
B seawater, stainless steel, nitrogen
C calcium oxide, orange juice, mercury
D sodium chloride, nitric oxide, zinc carbonate

24 The graph shows the temperature change of a liquid with time.



Between which points 1, 2, 3 and 4 are **all** the conditions below met?

- The distance between the particles decreases.
- The forces of attraction between the particles are strongest.
- The kinetic energy of the molecules is at its lowest.

A 1 to 2
B 2 to 3
C 3 to 4
D 1 to 2 and 3 to 4

25 Which element shows the correct number of protons and neutrons?

	element	number of protons	number of neutrons
A	$^{12}_{6}C$	6	12
B	$^{12}_{6}C$	12	6
C	$^{4}_{2}He$	4	2
D	$^{4}_{2}He$	2	2

26 Aqueous lead(II) nitrate and potassium sulfate were mixed.

Which of the following correctly shows the ionic equation for this reaction?

A $Pb^{2+}(aq) + SO_4^{2-}(aq) \rightarrow PbSO_4(s)$
B $Pb(NO_3)_2(aq) \rightarrow Pb^{2+}(aq) + 2NO_3^-(aq)$
C $Pb(NO_3)_2(aq) + K_2SO_4(aq) \rightarrow PbSO_4(s) + 2KNO_3(aq)$
D $Pb^{2+}(aq) + 2K^+(aq) + 2NO_3^-(aq) + SO_4^{2-}(aq) \rightarrow PbSO_4(aq) + 2KNO_3(aq)$

27 The oxide of an element X is added separately to dilute hydrochloric acid and aqueous sodium hydroxide.

The observations of the reactions are recorded in the table below.

	dilute hydrochloric acid	aqueous sodium hydroxide
observations on addition of oxide X	pH of solution increases	pH of solution decreases

Which row correctly describes element X and its oxide?

	X	oxide X
A	metal	basic
B	metal	amphoteric
C	non-metal	acidic
D	non-metal	amphoteric

28 The solubility of some salts in water is shown.

soluble	insoluble
copper(II) chloride	calcium sulfate
sodium chloride	lead(II) chloride
	barium carbonate

Which pair of aqueous solutions are mixed to prepare a salt using the titration method?

A calcium nitrate and sulfuric acid
B barium nitrate and sodium carbonate
C copper(II) sulfate and sodium chloride
D sodium hydroxide and hydrochloric acid

29 Hydrogen sulfide burns in excess oxygen as shown in the equation below.

$$2H_2S\ (g) + 3O_2\ (g) \rightarrow 2H_2O\ (l) + 2SO_2\ (g)$$

24 dm^3 of hydrogen sulfide and 48 dm^3 of oxygen were used in this reaction.

What is the volume of gaseous products formed at room temperature and pressure?

A 24 dm^3 **B** 48 dm^3 **C** 64 dm^3 **D** 96 dm^3

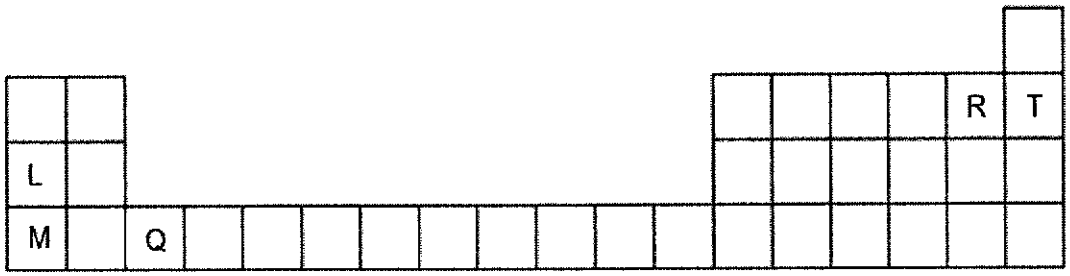
30 In the equation below, 50 cm^3 of 0.1 mol/dm^3 of nitric acid neutralised 40 cm^3 of aqueous potassium hydroxide.

$$HNO_3 + KOH \rightarrow KNO_3 + H_2O$$

What is the concentration of aqueous potassium hydroxide used?

A 0.080 mol/dm^3 **B** 0.800 mol/dm^3
C 0.125 mol/dm^3 **D** 1.25 mol/dm^3

31 The diagram shows the positions of elements L, M, Q, R and T in the Periodic Table.



The letters are **not** the chemical symbols of the elements.

Four statements about the elements are listed below.

1. L and R react to form a covalent molecule.
2. L, M and Q are metals.
3. T exists as diatomic molecules.
4. R and T have the same number of electron shells.

Which statements about the elements L, M, Q, R and T are correct?

A 1 and 2 **B** 1 and 3 **C** 2 and 3 **D** 2 and 4

32 The reactions of four metals are shown.

metal	reaction with cold water	reaction with steam	reaction with dilute acid
W	no reaction	slow reaction	slow reaction
X	slow reaction	violent reaction	violent reaction
Y	no reaction	no reaction	no reaction
Z	violent reaction	explosive reaction	explosive reaction

What is the order of reactivity for W, X, Y and Z?

	most reactive → least reactive			
A	W	X	Z	Y
B	X	Z	Y	W
C	Y	W	Z	X
D	Z	X	W	Y

33 Limestone is added to the blast furnace in the manufacture of iron.

Which of the following best describes its role inside the blast furnace?

A It removes acidic impurities.
B It reduces iron ore to molten iron.
C It increases the melting point of the iron ore.
D It increases the temperature within the blast furnace.

34 Small portions of aqueous potassium iodide and acidified potassium manganate(VII) were separately added to four solutions.

solution	potassium iodide	potassium manganate(VII)
1	colourless to brown	no change
2	colourless to brown	purple to colourless
3	no change	no change
4	no change	purple to colourless

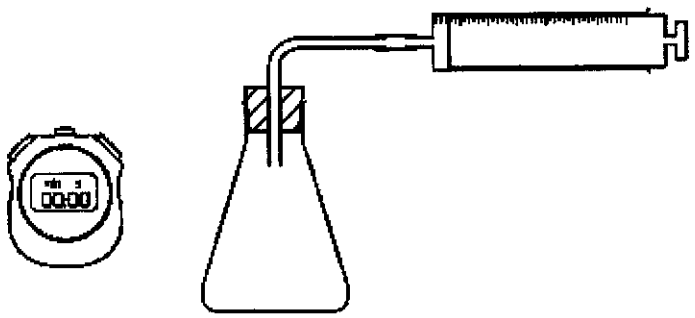
Which solution(s) contain an oxidising agent?

A 1 only **B** 1 and 2 **C** 2 and 4 **D** 3 only

35 Four different experiments were carried out using the same mass of magnesium reacting with the same volume of dilute sulfuric acid.
Which set of conditions will result in the magnesium being used up the fastest?

	reagent	concentration of acid (mol/dm^3)	temperature (°C)
A	magnesium powder	1	30
B	magnesium powder	2	70
C	magnesium ribbon	1	70
D	magnesium ribbon	2	30

36 The apparatus shown can be used to find the rate of some chemical reactions.



Which of the following pairs of reactants produced a reaction where the rate can be measured using these apparatus?

A $AgNO_3$ + KI
B $CuCO_3$ + HC*l*
C NaOH + $CuSO_4$
D NaOH + HC*l*

37 Four statements about endothermic reactions are given below.

1. Energy is released to the surroundings.
2. Energy is absorbed from the surroundings.
3. The temperature of the surroundings increases.
4. The temperature of the surroundings decreases.

Which statements are correct?

A 1 and 3
B 1 and 4
C 2 and 3
D 2 and 4

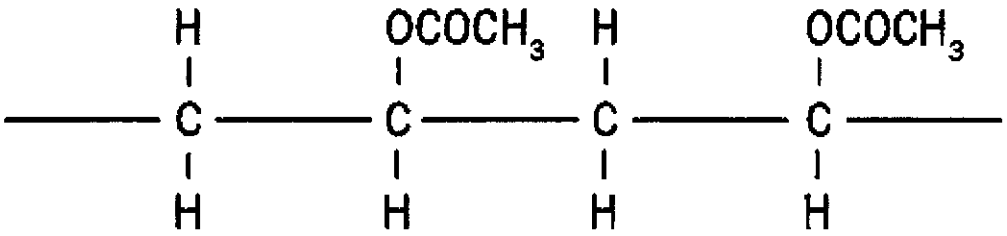
38 Which of the following substances will **most** likely cause acid rain?

A carbon soot produced from the incomplete combustion of coal
B sulfur dioxide produced from the burning of fuels in power stations
C carbon monoxide produced from the incomplete combustion of natural gas
D lead compounds produced from the burning of leaded petrol in motor vehicles

39 Which petroleum fraction is used as a fuel for aircraft engines?

A petrol
B diesel
C kerosene
D bitumen

40 A section of an addition polymer is shown.



Which row describes the monomer used to make this polymer?

	type of compound	effect of adding aqueous bromine
A	saturated	reddish-brown to colourless
B	saturated	remains reddish-brown
C	unsaturated	reddish-brown to colourless
D	unsaturated	remains reddish-brown

DATA SHEET

Colours of Some Common Metal Hydroxides

calcium hydroxide	white
copper(II) hydroxide	light blue
iron(II) hydroxide	green
iron(III) hydroxide	red-brown
lead(II) hydroxide	white
zinc hydroxide	white

The Periodic Table of Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 0
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9											5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24											13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium -	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57 – 71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
87 Fr francium –	88 Ra radium –	89 – 103 actinoids	104 Rf Rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –		114 Fl flerovium –		116 Lv livermorium –		

Key

proton (atomic) number
atomic symbol
name
relative atomic mass

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium –	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

NAME:	NO:	CLASS:

ADMIRALTY SECONDARY SCHOOL

PRELIMINARY EXAMINATION 2021

SUBJECT	:	Science (Physics)
CODE/PAPER	:	5076/2
LEVEL/STREAM	:	Secondary 4 Express Secondary 5 Normal (Academic)
DATE	:	27 Aug 2021
TIME	:	0800h – 0915h
DURATION	:	1 hour 15 minutes

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams, graphs, tables or rough working.
Do not use staples, paper clips, glue or correction fluid.
The use of an approved scientific calculator is expected, where appropriate.
You may lose marks if you do not show your working or if you do not use appropriate units.

Section A
Answer **all** questions.
Write your answers in the spaces provided on the question paper.

Section B
Answer any **two** questions.
Write your answers in the spaces provided on the question paper.

The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
Section A	/ 45
Section B	/ 20
Total	/ 65

DO NOT TURN OVER THIS PAPER UNTIL YOU ARE TOLD TO DO SO.

This question paper consists of **15** printed pages including this cover page.

Section A
Answer all questions

1 The masses and volumes of two materials X and Y found in a bracelet are shown in Table 1.1.

	material X in bracelet	material Y in bracelet
mass / g	63.9	23.1
volume / cm^3	3.31	2.59

Table 1.1

(a) Calculate the density of the bracelet.

density = ... g / cm^3 [2]

(b) The bracelet was placed in a liquid of density 13.6 g / cm^3. Will it float or sink? Explain your answer.

.....

.....

..... [2]

2 A student invents a machine to measure the force of the wind.
A large piece of light-weight material is used as a wind-catcher and is attached to the top of a mast.
A newton-meter is used to measure the turning force and is attached to the bottom of the mast.
The mast is free to rotate about a pivot as shown in Fig. 2.1.
Diagram in Fig. 2.1 is not drawn to scale.

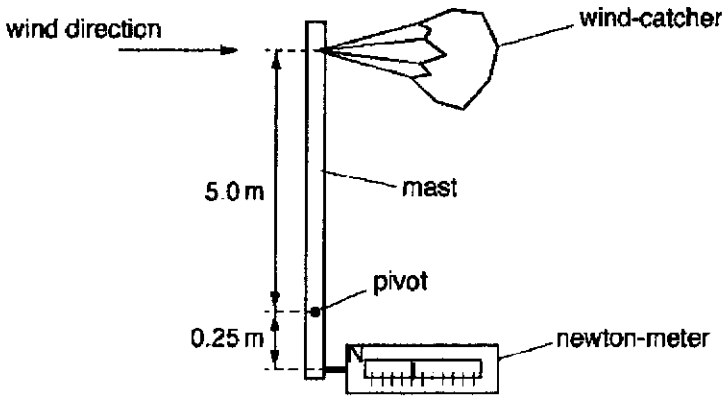


Fig. 2.1

(a) The newton-meter is attached 0.25 m from the pivot.
On a windy day the reading on the newton-meter is 52.0 N when the mast is vertical.

(i) Calculate the moment of the force applied by the newton-meter about the pivot.

moment = ... Nm [2]

(ii) The wind-catcher is attached 5.0 m from the pivot.
Calculate the force from the wind when the mast is vertical.

force = ... N [2]

(b) The newton-meter contains a spring. The energy in the spring in the newton-meter increases as the force acting on it increases from 0 N to 0.25 N.
Name this energy.

..... [1]

3 Fig. 3.1 shows a black car going up a hill on a sunny day.

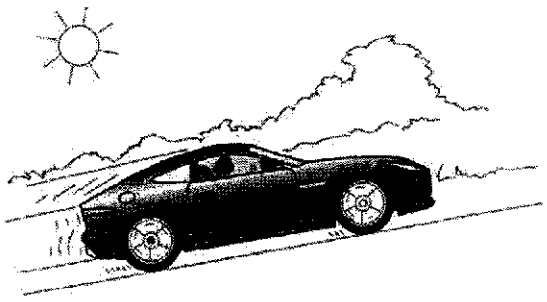


Fig. 3.1

(a) State

(i) one way in which the car is gaining thermal energy

.....

(ii) one way in which the car is losing thermal energy.

..... [2]

(b) The car accelerates up the hill. In addition to an increase in thermal energy, there are other energy transfers taking place.
Describe the other energy transfers.

.....

.....

..... [3]

(c) At one point in the motion, the kinetic energy of the car is 90 kJ.
The mass of the car is 800 kg.
Calculate the speed of the car.

speed = ...m/s [2]

4 Fig. 4.1 shows two copper cans of the same size and shape, A and B, containing water at different temperatures.

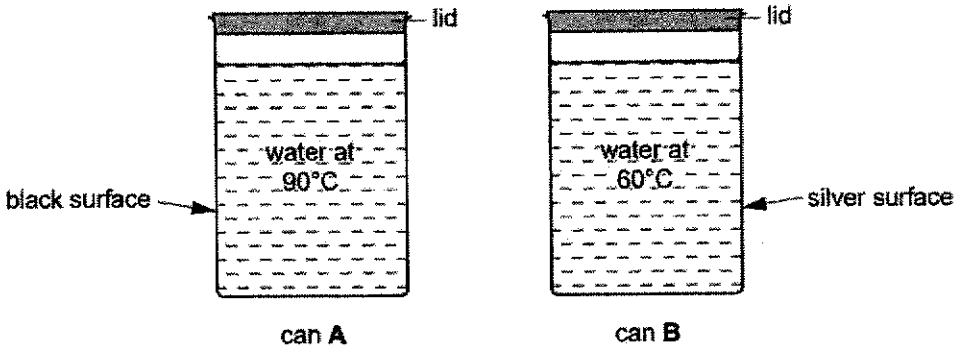


Fig. 4.1

Can A has a black surface and contains water at a temperature of 90 °C.
Can B has a silver surface and contains water at a temperature of 60 °C.

(a) Describe how heat is transferred through the cans.

.....

.....

.....

..... [3]

(b) Explain why can A loses heat more quickly than can B.

.....

.....

.....

..... [2]

5 Fig. 5.1 shows a section through the swimming pool in a hotel.
To make the pool more attractive at night, there are submerged lamps in the pool.
Fig. 5.1 shows three rays coming from one of these lamps.

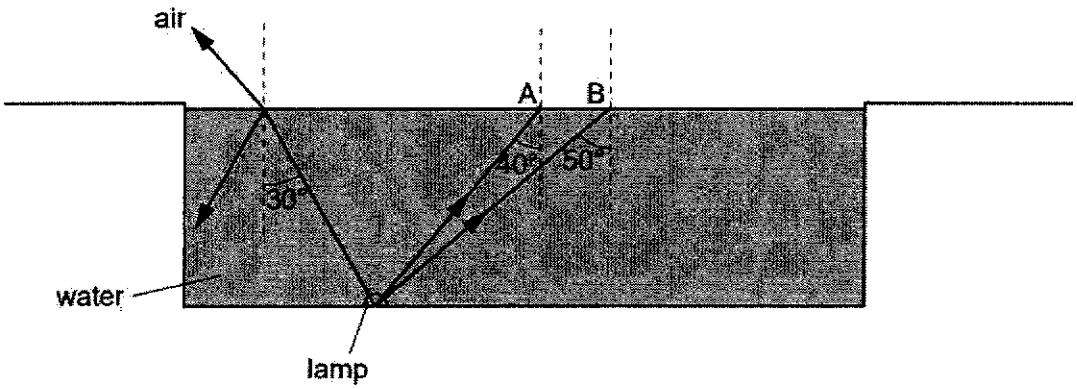


Fig. 5.1

The critical angle for the water/air boundary is 48 °.

(a) Explain what is meant by the critical angle for a ray of light.

.....

.....

.....

..... [3]

(b) On Fig. 5.1, use your ruler to draw approximate paths for the rays after they reach the surface at A and B. [3]

(c) Calculate the refractive index of water.

refractive index = ... [2]

6 Some sailors use sound waves to measure the depth of water beneath their ship. A pulse of sound is transmitted to the sea bed and returns to the ship. Fig. 6.1 shows the arrangement. The speed of sound in sea water is 1500 m / s.

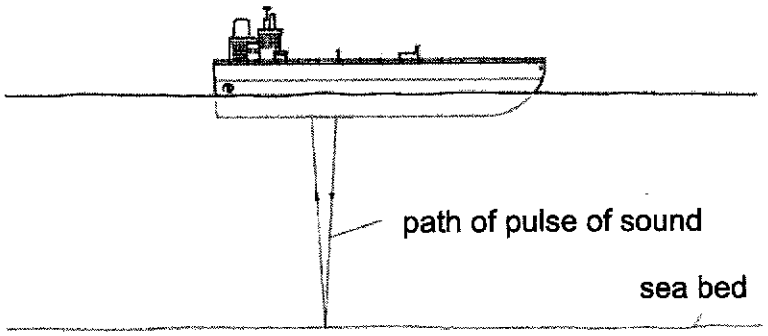


Fig. 6.1

(a) State why the pulse of sound returns to the ship.

.....

..... [1]

(b) Explain how sound waves travel through sea water.

.....

..... [2]

(c) The time taken for the sound pulse to reach the sea bed and then return to the ship is 0.20 s.
Calculate the depth of the sea.

depth = ... m [2]

(d) If the frequency of the sound wave is 30 kHz, calculate the wavelength of the sound wave.

wavelength = ... m [2]

7 Fig. 7.1 represents the electromagnetic spectrum

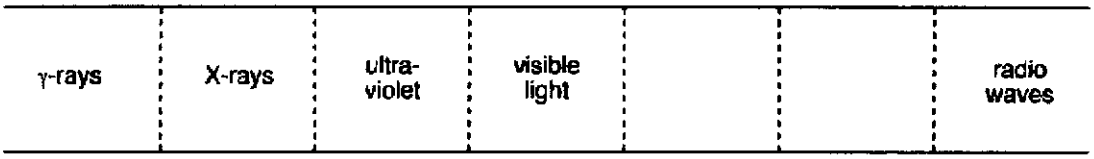


Fig. 7.1

(a) Identify one feature that is the same for all radiations that form the electromagnetic spectrum.

.....

..... [1]

(b) Fill in the blank spaces between visible light and radio waves by adding the names of the radiations. [2]

(c) State the radiation that has the shortest wavelength.

..... [1]

(d) Describe a common use of ultra-violet radiation.

..... [1]

8 Fig. 8.1 shows paint droplets sprayed from a paint gun. Each droplet has a negative charge. The paint droplets move away from each other. The droplets, however, are attracted to a metal surface nearby.

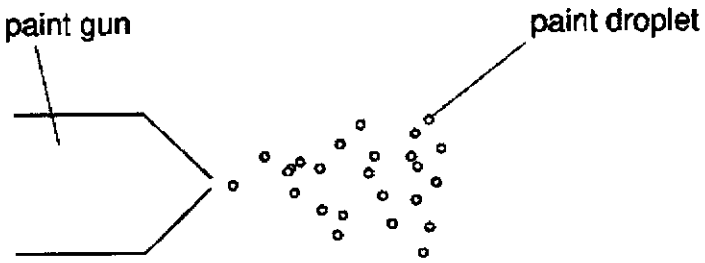


Fig. 8.1

(a) Explain why the paint droplets move away from each other.

.....

..... [1]

(b) Fig. 8.2 shows two negative charge particles.
Draw the electric field patterns between these charged particles. [1]

Fig. 8.2

(c) Suggest and explain why the droplets are attracted to metal surface nearby.

.....

..... [2]

Section B

Answer any **two** questions.

9 A man makes a parachute jump. Initially, he falls without opening his parachute. Then he opens his parachute and falls to the ground.
Fig. 9.1 shows how his speed changes with time after jumping.

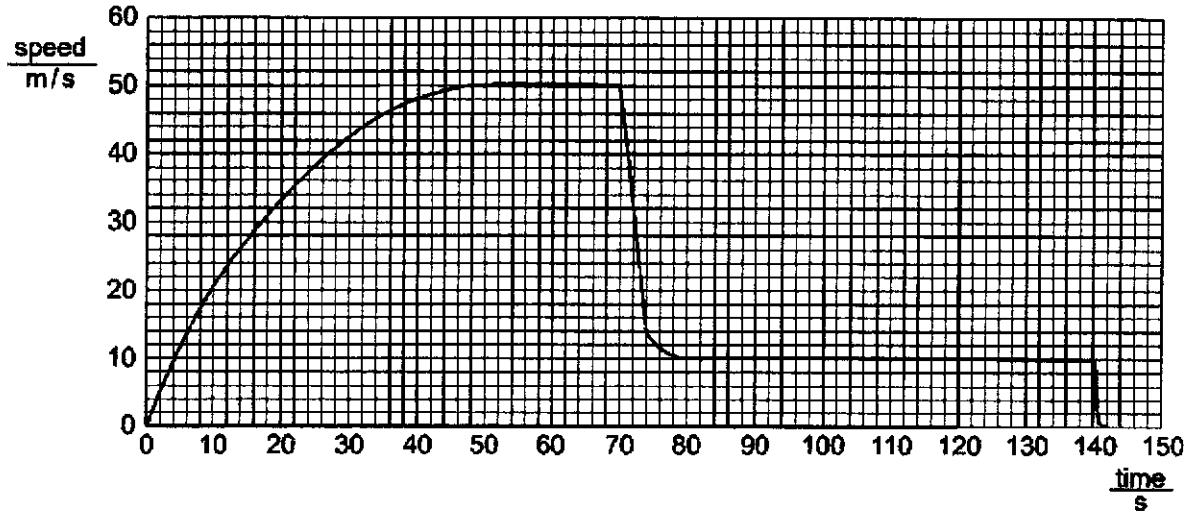


Fig. 9.1

(a) State

(i) the downward force acting on the parachutist,

..... [1]

(ii) the upward force acting on the parachutist as he falls,

..... [1]

(iii) the form of energy lost by the parachutist as he falls.

..... [1]

(b) **(i)** Between which two times does the man have a constant acceleration?

..... [1]

(ii) State the time at which the man opens his parachute.

..... [1]

(c) The parachutist accelerates during the first 40 seconds.
Explain how Fig. 9.1 shows that the acceleration is not constant

..... [1]

(d) Explain, in terms of the forces acting on the man, why he moves at constant speed between 50 s and 70 s.

.....

.....

..... [2]

(e) The parachutist has a mass of 80 kg. At one point during his descent, the net downward force on him is 300 N.
Calculate his acceleration.

acceleration = ... m/s^2 [2]

10 Fig. 10.1 shows two resistors, X and Y, connected in series. The resistance of X is 7.0 Ω. The ammeter reads 0.20 A. The voltmeter reads 2.0 V

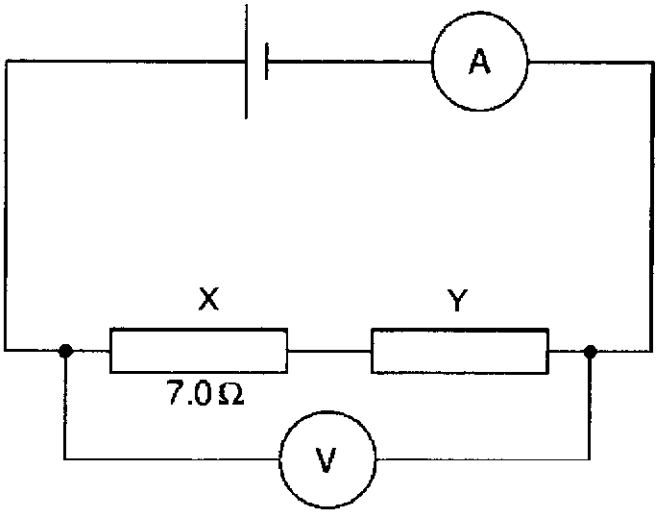


Fig. 10.1

(a) Calculate the charge that passes through resistor X in 3.0 minutes

charge = ...C [2]

(b) Determine potential difference across resistor X.

potential difference = ...V [2]

(c) Calculate the potential difference across resistor Y.

potential difference = ...V [1]

(d) Determine the resistance of resistor Y.

resistance = ... Ω [1]

(e) Determine the power dissipated by resistor Y.

power = ... W [2]

(f) The 7 ohms resistor in the circuit consists of a nichrome wire of length 0.3 m and cross-sectional area of 0.02 m^2.
Explain what will happen to the overall resistance of the circuit when this resistor is replaced by a nichrome wire of length 0.6 m and cross-sectional area of 0.01 m^2.

.....

.....

.....

..... [2]

11 Fig. 11.1 shows a student setting up waves on a long elastic cord. It is known that the frequency of the wave is 4.0 Hz.

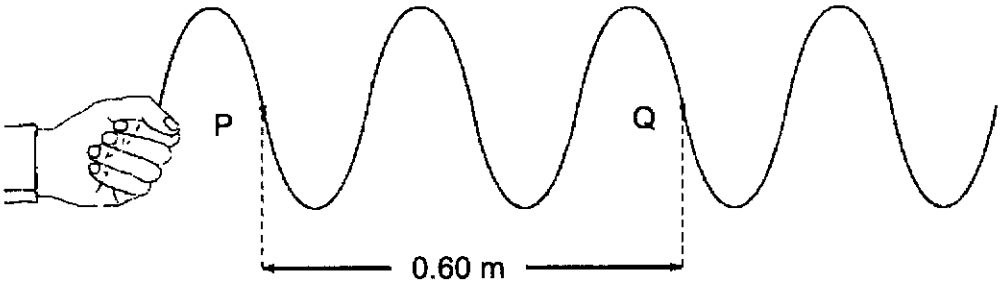


Fig. 11.1

The points P and Q are at the same horizontal level on the wave and the distance between the two points is 0.60 m.

(a) State what is meant by the *frequency of the wave is 4.0 Hz*.

.....

..... [1]

(b) Calculate the period of the wave.

period = ...s [1]

(c) State the time taken for the wave to travel from P to Q.

time = ... s [1]

(d) Calculate the speed of the wave.

speed = ...m/s [2]

(e) Calculate the distance travelled by the wave in 15 s.

distance = ...m [2]

(f) State whether the wave speed will increase, decrease or stay the same when the frequency of the wave is increased. Explain your answer.

.....

.....

.....

..... [2]

(g) Is the wave in Fig.11.1 more like a sound wave or a water wave?

..... [1]

END OF PAPER

Admiralty Secondary School
Marking Scheme
4E Science Physics (Paper 2)
PRELIMINARY EXAMINATION 2021

PAPER 1 [20 marks]

1	2	3	4	5	6	7	8	9	10
D	B	B	B	D	B	D	D	A	B

11	12	13	14	15	16	17	18	19	20
B	D	C	B	B	B	D	D	A	D

PAPER 2 SECTION A [45 marks]

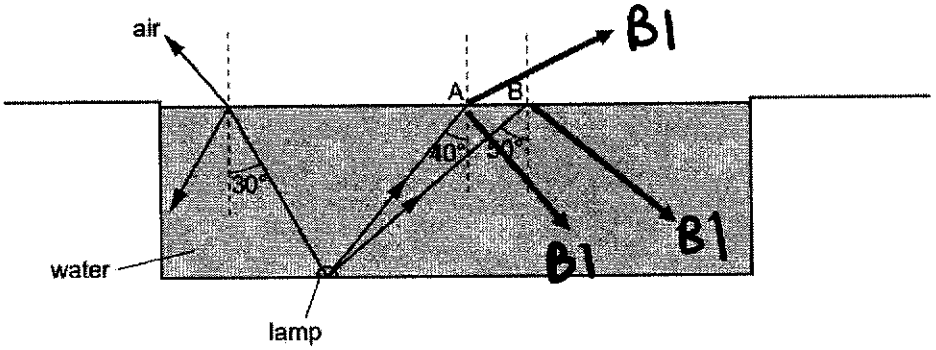
Qn.	Description	Mark	Remarks
1 (a)	density = $\frac{total\ mass}{total\ volume}$ = $\frac{63.9+23.1}{3.31+2.59}$ [M1] = 14.7 g / cm^3 [A1]	[2]	
(b)	Sink. [B1] It is denser than the liquid. [B1]	[2]	

2 (a) (i)	52 x 0.25 [M1] =13 Nm [A1]	[2]	
(ii)	F x d = 13 Nm F = 13/ 5 [M1] = 2.6 N [A1]	[2]	
(b)	elastic potential energy	[1]	

3 (a) (i)	heat gained from burning fuel / combustion or friction between moving parts / with air / road or from (radiation of) Sun [B1]	[1]	
(ii)	heat lost to air / surroundings or by convection (currents) or exhaust / hot gases / fumes or from exhaust or heat emitted (by hot car) or by radiation [B1]	[1]	
(b)	decrease in chemical energy [B1] in converted into increase in gravitational / potential energy (of car) and [B1] increase in kinetic energy (of car or air) [B1]	[3]	
(c)	KE = 1/2 mv^2 90 000 = ½ × 800 × v^2 [M1] v = 15 (m / s) [A1]	[2]	

4 (a)	Thermal energy is transferred from hotter water to cooler surrounding [B1] as vibrations/energy passed from particle to particle [B1]. Also due to electron diffusion with energetic electrons travelling to cooler region of can. [B1]	[3]	
(b)	black surfaces are better **emitter of radiation** than silver [B1] . Also it is at a higher temperature [B1]	[2]	("it is black" is not enough)

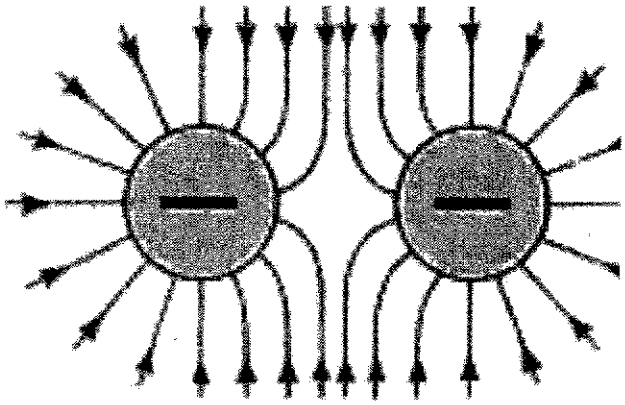
5 (a)	angle of incidence [B1] resulting in an angle of refraction of 90° [B1], beyond this angle the ray is totally internally reflected. Ray travelling from (optically) dense medium to less dense medium [B1]	[3]	
(b)	**ray at A** one refracted ray and one reflected ray [B1] refracted away from normal [B1] **ray at B** one reflected ray only angle of reflection is 50° (by eye) [B1]	[3]	



(c)	n = 1/ sin 48° [M1] = 1.35 [A1]	[2]	

6 (a)	Reflection of wave from sea bed. [B1]	[1]	
(b)	vibrations passed from particle to particle [B1] to form compressions and rarefactions that travels in the direction of sound waves [B1]	[2]	
(c)	d = v x t = 1500 x 0.1 [M1] = 150 m [A1]	[2]	
(d)	V= f λ 1500 = 30,000 x λ [M1] λ = 0.05 m [A1]	[2]	

7 (a)	transverse waves OR travel at same (high) speed OR travel across a vacuum [B1]	[1]	
(b)	• infra-red next to visible [B1] • microwaves next to radio waves [B1]	[2]	
(c)	gamma rays [B1]	[1]	
(d)	Sunbed OR forgery detection of notes [B1]	[1]	

8 (a)	Like charges repel [B1]	[1]	
(b)	pattern must symmetrical with the neutral zone and arrow directions correct [B1] 	[1]	
(c)	Metal plates are positively chaged. [B1] Unlike charges attract. [B1]	[2]	

PAPER 2 SECTION B [20 marks]

Qn.	Description	Mark	Remarks
9 (a) (i)	gravity / weight [B1]	[1]	
	air resistance [B1]	[1]	
(ii)	gravitational potential energy [B1]	[1]	
(b) (i)	0s to 6s	[1]	
(ii)	70s	[1]	
(c)	line is curved / not straight [B1]	[1]	
(d)	Total Upward force = total downward force [B1] Resultant force = 0 [B1] Reject : any relevance to Newton's 3rd Law	[2]	
(e)	F = ma or a = F/m OR 300/80 [M1] = 3.75 m/s^2 [A1]	[2]	

Qn.	Description	Mark	Remarks
10 (a)	Q=It = 0.20 x 3 x 60 [M1] = 36 C [A1]	[2]	
(b)	V= IR = (0.2) (7) [M1] = 1.4 V [A1]	[2]	allow ecf
(c)	pd = 2- 1.4 = 0.6 V [B1]	[1]	allow ecf 10b
(d)	R = V/I = 0.6/0.2 = 3.0 ohms [B1]	[1]	allow ecf 10c
(e)	P = VI = 0.6 x 0.2 [M1] = 0.12 A [A1]	[2]	Allow ecf 10c
(f)	Overall resistance of circuit increases. [B1] Increase the length of wire by 2 times doubles the resistance of wire. Reduce cross sectional area by half doubles the resistance further [B1].	[2]	

11 (a)	It means that 4 complete waves/oscillations is generated in 1 second. [B1]	[1]	
(b)	T= 1/f = ¼ = 0.25 Hz [B1]	[1]	
(c)	time = 2 x period = 0.5 s [B1]	[1]	allow ecf (b)
(d)	speed = 4 x 0.3 [M1] = 1.2 m/s [A1]	[2]	
(e)	Distance = speed x time = 1.2 x 15 [M1] = 18.0 m [A1]	[2]	allow ecf (d)
(f)	• It will not affect the speed. [B1] • This is because wave speed is affected by a change in the wave medium. [B1]	[2]	
(g)	• Water wave	[1]	