Cambridge Assessment International Education

Cambridge O Level

PHYSICS **5054/11**

Paper 1 Multiple Choice **May/June 2021**

1 hour

You must answer on the multiple choice answer sheet.

You will need: Multiple choice answer sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

INSTRUCTIONS

- 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 multiple choice answer sheet.
- Follow the instructions on the multiple choice answer sheet.
- Write in soft pencil.
- Write your name, centre number and candidate number on the multiple choice answer sheet in the spaces provided unless this has been done for you.
- Do **not** use correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.

INFORMATION

- The total mark for this paper is 40.
- Each correct answer will score one mark.
- Any rough working should be done on this question paper.

This document has **16** pages.

[Turn over

1 A list of various quantities is shown.

acceleration
displacement
force
length
mass
velocity

How many of these quantities are vectors?

A 2 **B** 3 **C** 4 **D** 5

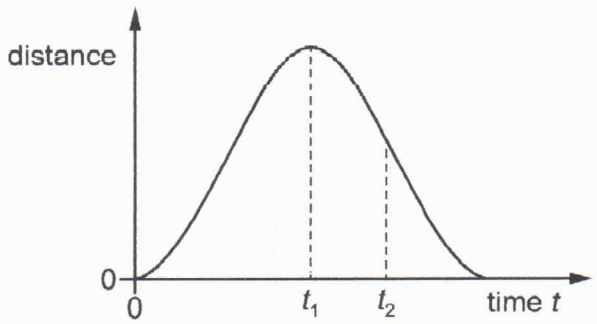
2 A student determines the circumference of a football.

Which instrument gives a reading that is the circumference of the football?

A calipers
B micrometer
C rule
D tape

Because it can be wound about the ball.

3 A train sets off from a station at time $t = 0$. The graph shows how the distance between the train and the station varies with time.

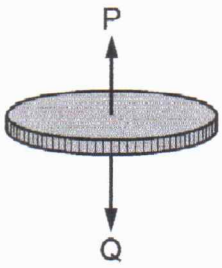


Which statement about the movement of the train between time t_1 and t_2 is correct?

A Its speed is decreasing and it is moving away from the station.
B Its speed is decreasing and it is moving towards the station.
C Its speed is increasing and it is moving away from the station.
D Its speed is increasing and it is moving towards the station.

4 A coin falls from rest through the air and eventually reaches a constant speed.

There is a resultant force acting on the coin due to the two forces P and Q shown in the diagram.



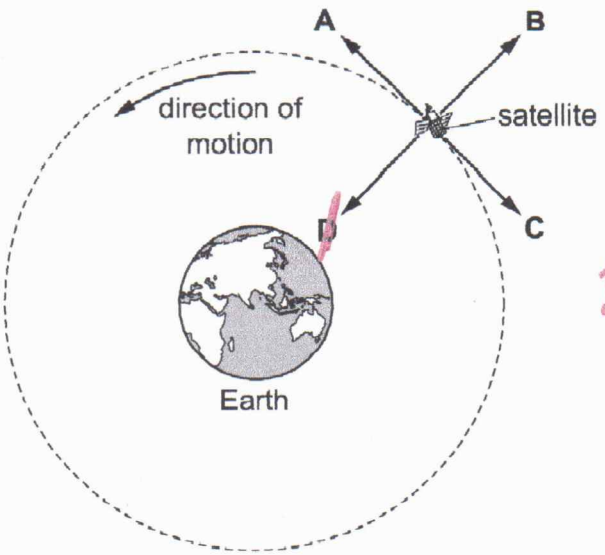
What happens to force P and what happens to the resultant force before the coin reaches constant speed?

	force P	resultant force
A	decreases	increases
B	decreases	decreases
C	increases	decreases
D	increases	increases

Drag force increases with speed and the resultant force decrease till it is zero at V_T.

5 A satellite is shown moving around the Earth in a circular path at a constant speed.

Which arrow shows the direction of the force on the satellite?



not to scale

D - Centripetal force: "Centre Seeking force" that causes Centripetal acceleration.

6 Which row shows the mass and the weight of an object on the Earth's surface?

[gravitational field strength g = 10 N/kg]

$W = m(kg) \times g$.

	mass / kg	weight / N
A	2	0.20
B	2	10
C	5	5.0
D	5	50

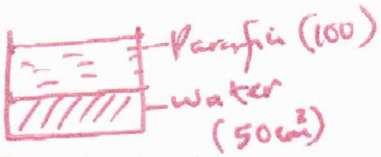
$2 \times 10 = 20$

$2 \times 10 = 20$

$5 \times 10 = 50$

✓

7 Water is added to a measuring cylinder containing 100 cm^3 of liquid paraffin.



(The density of paraffin is 0.80 g/cm^3 and that of the water is 1.0 g/cm^3.)

As the water is added, the level of the paraffin rises to 150 cm^3. The paraffin and water do not mix.

Mass of water = $\rho_w \times V_w = 1 \times 50 = 50$ g

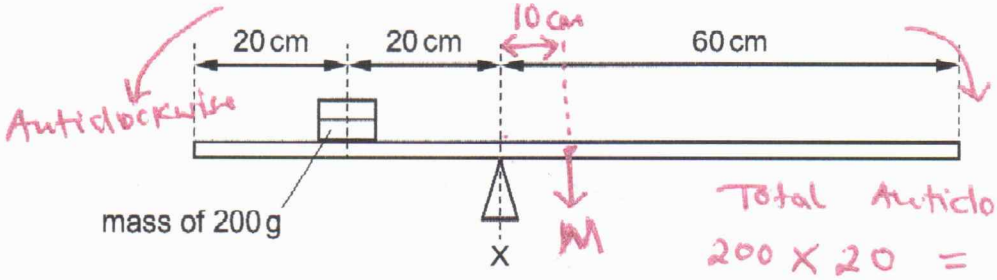
Mass of paraffin = $\rho_p \times V_p = 0.8 \times 100 = 80$ g

What finally is the total mass of liquid in the measuring cylinder?

A 130 g B 140 g C 167 g D 175 g

Total = 80 + 50 = 130

8 A horizontal beam is pivoted at X. A mass of 200 g rests on the beam as shown. The centre of mass of the beam is 50 cm from the right-hand end of the beam.



Total Anticlockwise Moments

$200 \times 20 = 4000$

Total Clockwise Moments.

$M \times 10 = 10M$

The beam is balanced.

What is the mass of the beam?

A 80 g B 100 g C 400 g D 800 g

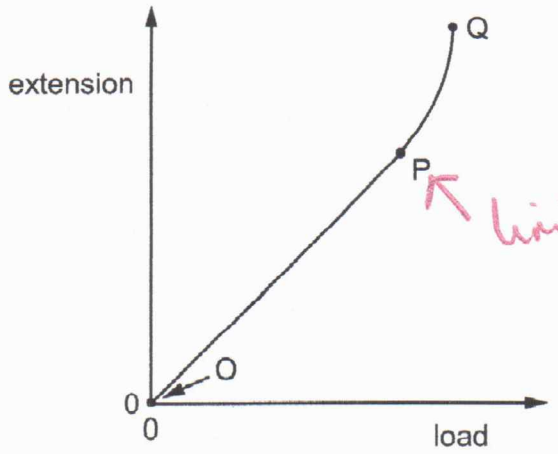
By Principle of Moments:

Total Clockwise Moments = Total Anticlockwise Moments.

$\frac{10M}{10} = \frac{4000}{10}$

$M = 400$ g

9 Where on the graph is the limit of proportionality for an elastic solid?



limit of proportionality → The point below which Hooke's law is obeyed. Past which Hooke's law is not obeyed.

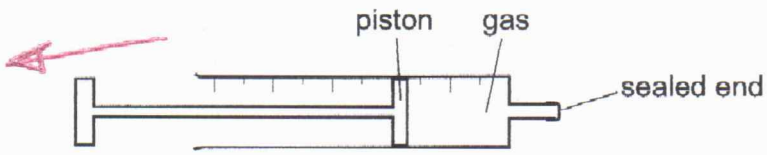
A between O and P

B at P

C between P and Q

D at Q

10 A sealed gas syringe contains a fixed mass of gas.



The piston is moved and the volume of the gas doubles. The temperature of the gas does not change.

What happens to the pressure of the gas?

Pressure $\propto \frac{1}{\text{Volume}}$

$P \propto \frac{1}{V}$ or $P = \frac{K}{V}$

if V double $PV = K$.

$K = 2PV$

$P_1V_1 = P_2V_2 = K$

$P_1V_1 = K$

$P_1 = \frac{K}{V_1}$

$P_2 = \frac{K}{2V_1}$

$\frac{P_2}{P_1} = \frac{K}{2V_1} \times \frac{V_1}{K}$

$P_2 = \frac{1}{2}P_1$

A halves

B no change

C doubles

D triples

11 Which expression for pressure is correct?

A force × area

B force ÷ area

C mass × area

D mass ÷ area

12 At a depth d in sea-water, the total pressure experienced by a diver is $2P$, where P is atmospheric pressure.

Pressure due to depth = $2P - P = P$.
$P = d\rho g$. under $4P \Rightarrow 4P - P = 3P = x\rho g$
$3P = x\rho g$, $P = d\rho g$ ⇒ $3(d\rho g) = x\rho g$, $x = 3d$

At which depth is the pressure $4P$?

A $1.5d$ **B** $2d$ **C** $3d$ **D** $4d$

13 The work done by a force F on a body is calculated by multiplying F by a quantity q.

Work done = force × distance travelled in the direction of force.

What is q?

A the distance travelled in the direction of the force

B the distance travelled perpendicular to the direction of the force

C the velocity in the direction of the force

D the velocity in the direction perpendicular to the force

14 Some solar panels have a total area of $12\,m^2$.

Each $1.0\,m^2$ of the panels receives $0.85\,kJ$ of energy from the Sun in $1.0\,s$.

The efficiency of the panels is 16%.

How much power do they produce?

$1.0\,m^2 = 0.85\,kJ$
$12.0\,m^2 = 10.2\,kJ$ ← Total energy

$P = E/t = \frac{10.2\,kJ}{1.0\,s}$
$P = 10.2\,kW$

Eff = $\frac{16}{100} \times 10.2\,kW$
$= 1.6\,kW$.

A 1.6 kW **B** 2.2 kW **C** 64 kW **D** 160 kW

15 A copper rod is heated at one end.

Which statement describes how heat transfer occurs in the copper?

A Energetic copper molecules move from the cooler end to the hotter end.

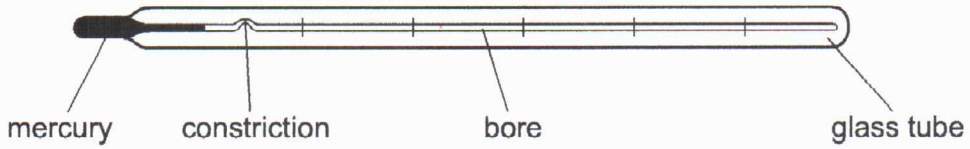
B Energetic copper molecules move from the hotter end to the cooler end.

C Energetic free electrons move from the cooler end to the hotter end.

D Energetic free electrons move from the hotter end to the cooler end.

In solids, thermal mode of heat transfer is Conduction.
Conduction occurs by free electrons transferring thermal energy and vibration of lattice or ions by which they transfer energy to the neighbouring particles.

16 The diagram shows a clinical thermometer.



Which factor affects the sensitivity of the thermometer?

A the constriction

B the diameter of the bore

C the length of the glass tube

D the thickness of the glass tube

The thinner the bore the more sensitive it is, because it will have max expansion.

17 Which row is correct for a thermocouple thermometer?

	measures very high temperatures	responds quickly to change in temperature
A	no	no
B	no	yes
C	yes	no
D	yes	yes

18 What is the *heat capacity* of a body?

A the amount of thermal energy that the body can absorb without melting

B the amount of thermal energy required to raise the temperature of the body by 1.0 °C

C the amount of thermal energy required to raise the temperature of 1.0 kg of the body by 1.0 °C → This is the "specific" heat capacity

D the amount of thermal energy required to raise the temperature of 1.0 m^3 of the body by 1.0 °C

19 Which statement about water is correct?

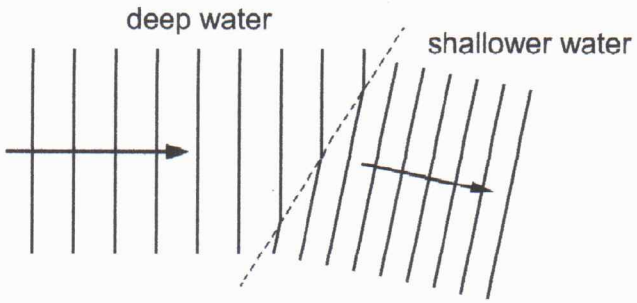
A At the boiling point, water vapour molecules have the same kinetic energy as liquid water molecules.

B Evaporation occurs only at the boiling point.

C Water molecules become heavier when water freezes.

D Water molecules lose all of their kinetic energy when water freezes.

20 A water wave in a ripple tank refracts as it moves from deep water into shallower water.

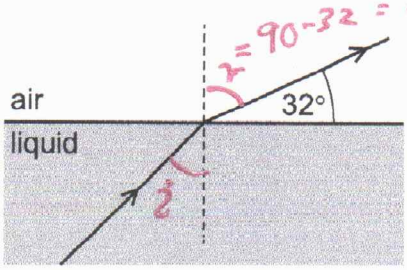


What happens to the speed and to the frequency of the wave as it moves into shallower water?

	speed	frequency
A	decreases	stays constant
B	increases	stays constant
C	stays constant	decreases
D	stays constant	increases

As frequency is a constant and λ decreases v. decreases since $v \propto \lambda$.

21 Light refracts from a liquid into air as shown.



not to scale

$r = 90 - 32 = 58°$

$\frac{\sin r}{\sin i} = 1.4$ or $\frac{\sin i}{\sin r} = \frac{1}{1.4}$

$\sin i = \frac{1}{1.4} \times \sin r$

$= \frac{\sin 58}{1.4} = 0.606$

$i = \sin^{-1} 0.606 = 37$

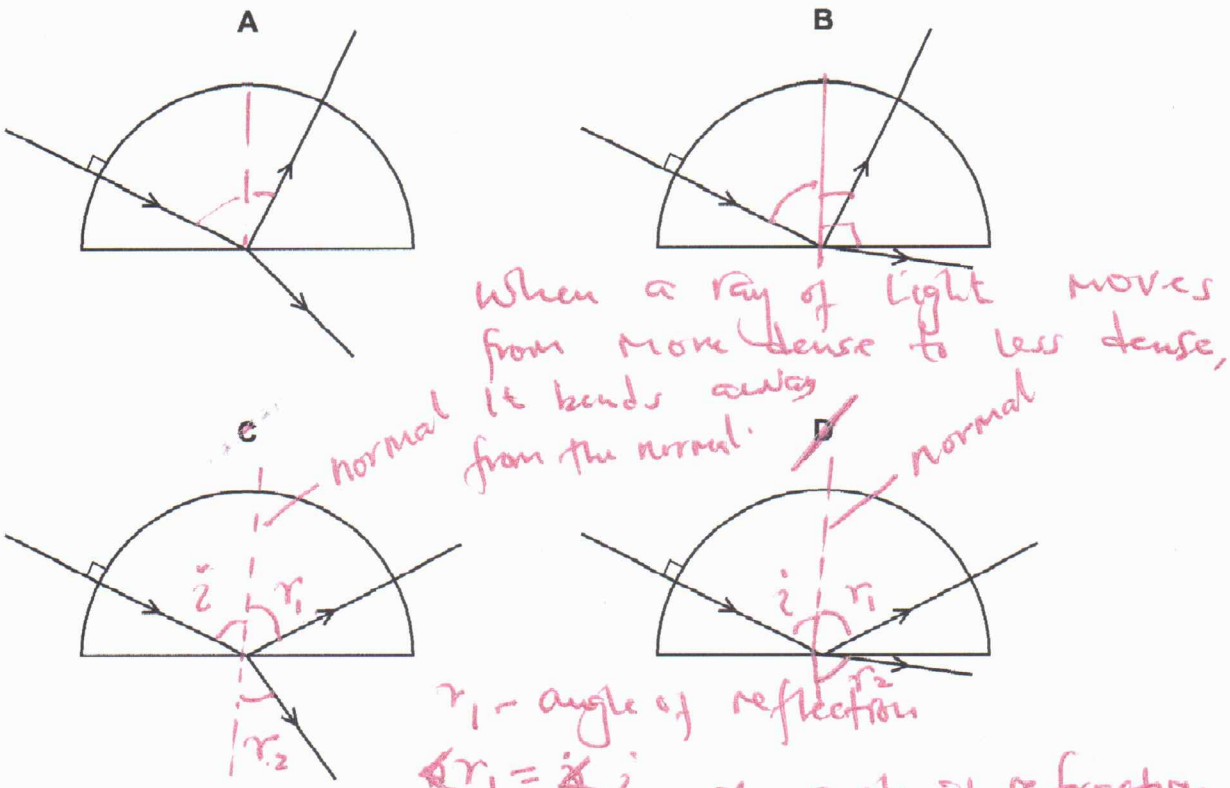
The refractive index for light moving from air to the liquid is 1.4.

What is the angle of incidence in the liquid?

A 22° **B** 37° **C** 41° **D** 45°

22 A ray of red light in air enters a semi-circular block.

Which diagram shows the partial reflection and the refraction of the ray?



When a ray of light moves from more dense to less dense, it bends away from the normal.

r_1 - angle of reflection

$r_1 = i$, r_2 - angle of refraction.

23 Which statement about human vision is correct?

A In a normal eye, the image on the retina is magnified and upright.

B In a long-sighted eye, distant objects form images in front of the retina.

C Short-sighted eyes produce only virtual images.

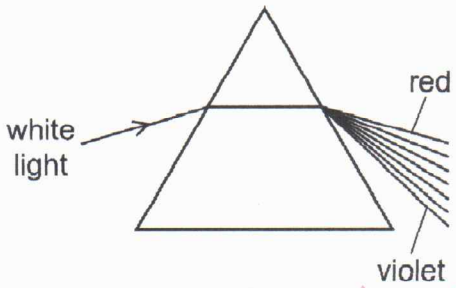
D Short-sight is corrected by the use of a diverging lens.

24 White light enters a prism and forms a spectrum.

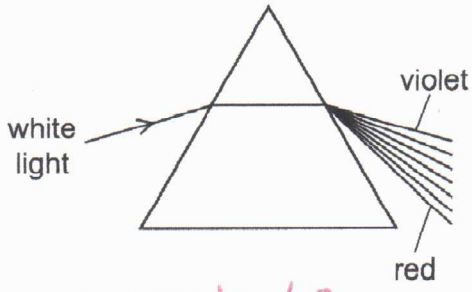
The rays in the air are labelled.

Which diagram shows how the white light is dispersed by the prism?

A

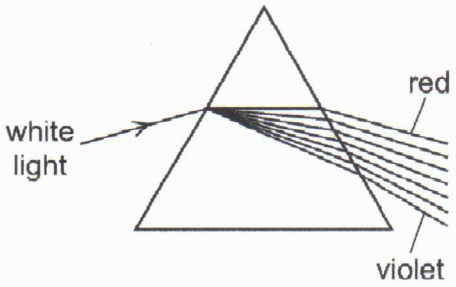


B

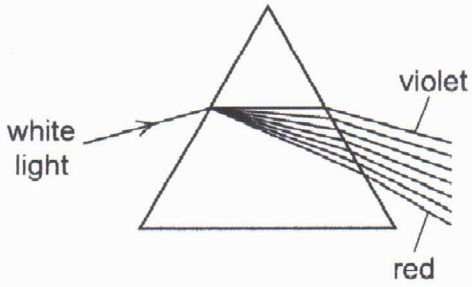


Since each colour has different wavelength / frequency, they will travel with different speed in the prism and be dispersed

C



D



25 The sound from a ship is reflected by a cliff. An echo is heard by a sailor on the ship 4.0 s after the sound is made. The speed of sound in air is 320 m / s.

distance = speed × $\frac{\text{time}}{2}$

= 320 × $\frac{4}{2}$ = 640

How far from the cliff is the ship?

A 160 m **B** 640 m **C** 1280 m **D** 2560 m

26 End X of a metal rod attracts the North pole of a compass needle.

Which statement about the rod is correct?

A It is made of copper that is not initially magnetised.

B It is made of copper with a South pole at X.

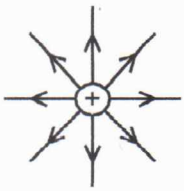
C It is made of steel that is not initially magnetised.

D It is made of steel with a North pole at X.

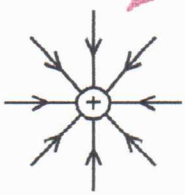
A Compass needle will always point toward south for a magnetic field.

27 Which diagram shows the pattern and direction of the electric field lines near a positive charge?

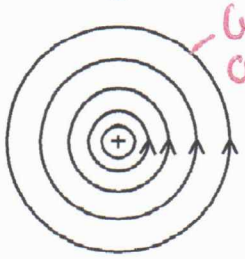
A



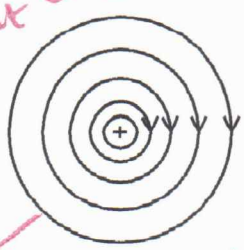
B



C



D

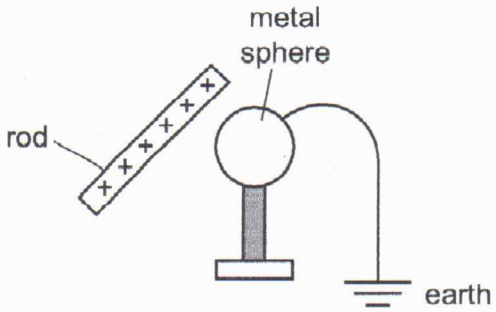


negative

Current outward from a current carrying wire.

Current into the page on a wire

28 A positively charged rod is held close to an insulated metal sphere. The sphere is earthed as shown.



The earth connection is removed and then the rod is removed.

Which diagram shows the charges on the sphere after the rod is removed?

A

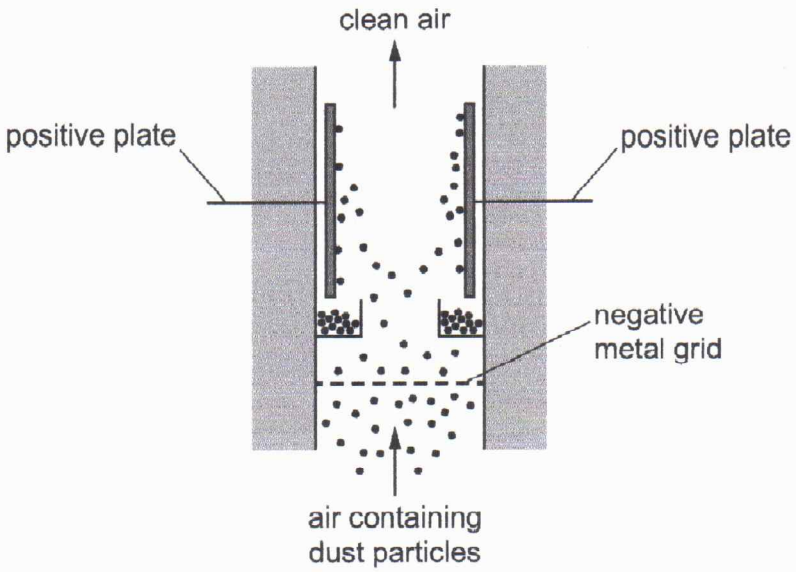
B

C

D

- electrons will be attracted to the metal sphere's surface.
- Then they will flows from the ground (electrons) through the earth and positive charge will be neutralised.
- After the rod is withdrawn, the negative charges spread on the whole sphere.

29 The diagram shows an electrostatic precipitator. It can be used to remove dust from air.



What happens at the negative grid?

They gain electrons and then stick on positive plate above the negative grid.

A Dust particles gain electrons.

B Dust particles gain protons.

C Dust particles lose electrons.

D Dust particles lose protons.

30 A 100 W lamp is switched on for five hours each day for three weeks.

1 unit = 1 kWH.

The cost of one unit of electricity is $0.24.

= 100W x 5 x 3 x 7

= 10500 WH ⇒ 10,500 / 1000

= 10.5 kWH

How much does it cost to run the lamp for this time?

A $0.36 **B** $0.84 **C** $2.52 **D** $25.20

10.5 x 0.24 = 2.52

31 The information on the back of an electric room heater is shown.

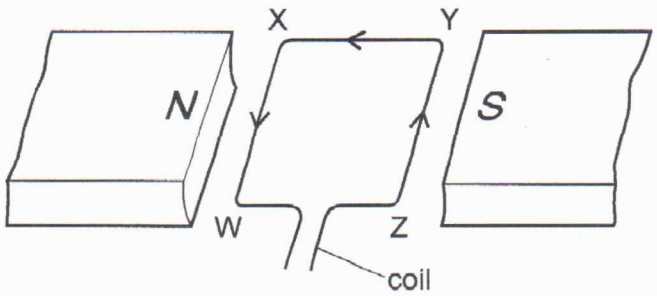
rating 220–240 V
~50 Hz
4.2 A

Slightly above this value of current.

What is a suitable fuse rating for this room heater?

A 4.0 A **B** 4.2 A **C** 5.0 A **D** 13.0 A

32 The diagram shows a horizontal rectangular wire coil WXYZ between the poles of a magnet.



There is a current in the coil in the direction shown.

Which statement is correct?

A The side WX experiences an upward force.

B The side XY experiences an outward force.

C The side YZ experiences an inward force.

D The side ZW experiences a downward force.

33 Which energy transfer takes place in an electric kettle?

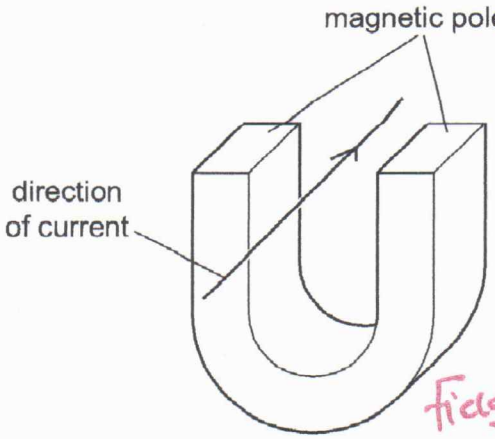
A chemical to electrical

B electrical to heat

C electrical to chemical

D heat to electrical

34 The diagram shows a current-carrying conductor between the poles of a magnet. The force on the wire acts downwards.



Current
Field
Force

Field
Current
Force

[Flemings Left Hand Rule]

Four changes are possible.

1 The current is increased. ✓

2 A stronger magnet is used. ✓

3 The current is reversed. ✓

4 The poles exchange positions. ✓

Which two changes made together keep the force acting downwards?

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

35 In an alternating current (a.c.) generator, a magnet rotates near a coil of wire. The induced electromotive force (e.m.f.) in the coil is displayed on an oscilloscope screen.

Which trace is produced as the magnet slows down?

As the magnet slows down, the rate of change of flux reduces and there will be less induced EMF.

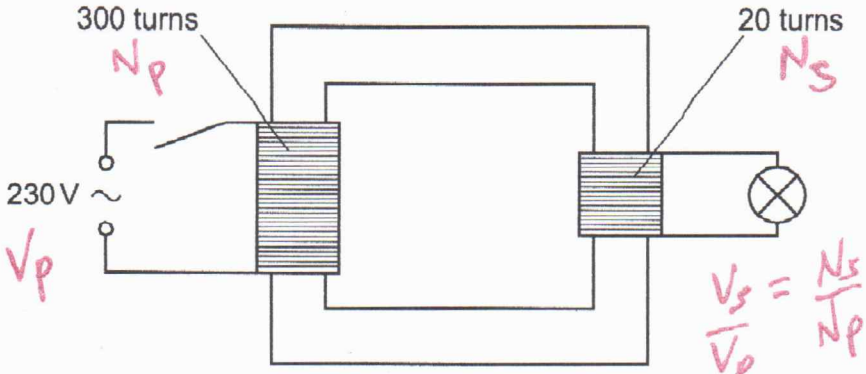
A

B

C

D

36 A student uses a transformer to light a filament lamp using a 230 V a.c. supply. The lamp has a maximum voltage rating of 6.0 V.



$\frac{V_s}{V_p} = \frac{N_s}{N_p} \Rightarrow V_s = \frac{N_s}{N_p} \times V_p$

$V_s = \frac{20}{300} \times 230$

$= 15.3\,V$

What happens when the circuit is switched on?

A The lamp does not light at all.

B The lamp lights at normal brightness.

C The lamp lights dimly.

D The lamp lights up brightly and then goes out.

37 Which statement about nuclear fusion is correct?

Nuclear fission – Splitting of Large unstable nucleus

Fusion – Joining of lighter nuclei. occurs in stars.

A Nuclear fusion occurs at low temperatures. ×

B Nuclear fusion occurs only between heavy nuclei. ×

C Nuclear fusion occurs in the formation of many stars.

D Nuclear fusion powers most electricity-generating stations. ×

38 In one radioactive decay, radium-226 decays to radon-222 as shown.

$$^{226}_{88}Ra \rightarrow {}^{222}_{86}Rn + {}^{4}_{2}X \Rightarrow {}^{4}_{2}He$$

226 − 222 = 4

88 − 86 = 2

Which particles are also produced?

A both an alpha-particle and a beta-particle

B an alpha-particle only

C a beta-particle only

D a neutron

39 The count rate from a radioactive source falls from 4000 counts per minute to 500 counts per minute in 72 minutes.

What is the half-life of the source?

A 8 minutes

B 9 minutes

C 18 minutes

D 24 minutes

$\frac{4000}{2} = 2000$ — 1-half life $t_{1/2}$

$\frac{2000}{2} = 1000$ — $2t_{1/2}$

$\frac{1000}{2} = 500$ — $3t_{1/2}$.

If $3t_{1/2} = 72$ mins $\Rightarrow \frac{72}{3} = 24$

$1t_{1/2} = ?!$

40 Which particles are found inside the nucleus of an atom?

A neutrons and electrons

B electrons and protons

C neutrons only

D neutrons and protons