Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate 2018

Marking Scheme

Physics

Ordinary Level

Note to teachers and students on the use of published marking schemes

Marking schemes published by the State Examinations Commission are not intended to be standalone documents. They are an essential resource for examiners who receive training in the correct interpretation and application of the scheme. This training involves, among other things, marking samples of student work and discussing the marks awarded, so as to clarify the correct application of the scheme. The work of examiners is subsequently monitored by Advising Examiners to ensure consistent and accurate application of the marking scheme. This process is overseen by the Chief Examiner, usually assisted by a Chief Advising Examiner. The Chief Examiner is the final authority regarding whether or not the marking scheme has been correctly applied to any piece of candidate work.

Marking schemes are working documents. While a draft marking scheme is prepared in advance of the examination, the scheme is not finalised until examiners have applied it to candidates' work and the feedback from all examiners has been collated and considered in light of the full range of responses of candidates, the overall level of difficulty of the examination and the need to maintain consistency in standards from year to year. This published document contains the finalised scheme, as it was applied to all candidates' work.

In the case of marking schemes that include model solutions or answers, it should be noted that these are not intended to be exhaustive. Variations and alternatives may also be acceptable. Examiners must consider all answers on their merits, and will have consulted with their Advising Examiners when in doubt.

Future Marking Schemes

Assumptions about future marking schemes on the basis of past schemes should be avoided. While the underlying assessment principles remain the same, the details of the marking of a particular type of question may change in the context of the contribution of that question to the overall examination in a given year. The Chief Examiner in any given year has the responsibility to determine how best to ensure the fair and accurate assessment of candidates' work and to ensure consistency in the standard of the assessment from year to year. Accordingly, aspects of the structure, detail and application of the marking scheme for a particular examination are subject to change from one year to the next without notice.

SECTION A (120 MARKS)

Answer **three** questions from this section.
Each question carries 40 marks.

Question 1 40 marks

An experiment was set up to verify Boyle's law.

(i) Draw a labelled diagram of the apparatus used in this experiment **6 + 2 × 3**

labelled diagram to show:
enclosed volume of gas / air 6
method of measuring volume e.g. volume scale
method of measuring pressure e.g. pressure gauge
method of varying pressure / volume any two 2 × 3

NOTE: no labels, deduct 2, incorrect experiment maximum mark 3× 3

The table shows the measurements obtained during the experiment.

(*ii*) How were the pressure and volume measured? **9 or 6 or 3**

measure the pressure from the pressure gauge
measure the volume of trapped air from the scale on the tube two correct 9
any one (6)
partial answer (3)

(*iii*) Copy and complete the table. **6 × 1**

V (cm^3)	2	3	4	5	6	9
p (kPa)	535	350	270	215	180	120
$1/V$ (cm^{-3})	**0.50**	**0.33̇**	0.25	**0.20**	**0.16̇**	**0.11̇**

one mark for filling in each 1/volume including value given 6 × 1

(*iv*) Explain how the data can be used to verify Boyle's law. **2 × 3**

use the data to draw a graph of p versus $1/V$ // pV 3
(straight) line through origin /shows that pressure ∝ 1/volume // =constant 3
partial answer 3

(*v*) State two precautions which the student might have taken to improve the accuracy of this experiment. **7 or 4**

after changing pressure wait a short time
ensure constant temperature
read the volume of the oil from the bottom of the meniscus
read the volume scale at eye level/no parallax
take many readings
safety precaution e.g. do not exceed the pressure limit of the apparatus, etc.
any line merits (4) any two lines 7

Question 2 **40 marks**

An experiment was set up to establish the calibration curve of a thermometer.

***(i)* Draw a labelled diagram of the apparatus used in this experiment** **4 × 3**

labelled diagram to show:
beaker of water
standard thermometer
uncalibrated thermometer
heat source
means of recording thermometric property
detail to improve the accuracy e.g. stirrer

any four lines 4 × 3

NOTE: no labels, deduct 2, incorrect experiment maximum mark 3× 3

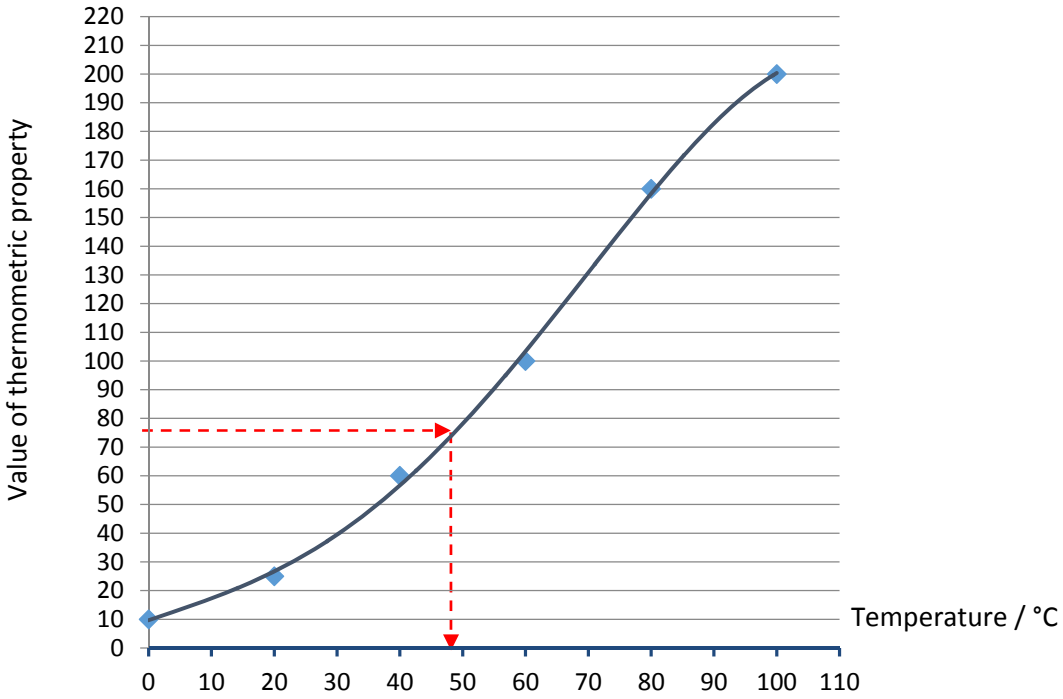
(*ii*) What measurements were taken during this experiment? **9 or 6 or 3**

thermometric property
temperature two correct 9
one correct (6)
partial answer e.g. using ohmmeter / multimeter / metre stick, etc. (3)

***(iii)* Use the data in the table to draw a graph, on graph paper, to establish the calibration curve. Put temperature on the horizontal (X) axis.** **4 × 3**

label axes correctly, (name / symbol / unit acceptable) 3
plot three points correctly 3
plot another three points correctly 3
smooth curve 3
if graph paper is not used, maximum mark 3 × 3
if temperature is on the Y-axis, maximum mark 3 × 3

***(iv)* Use your graph to determine the temperature when the value of the thermometric property is 75.** **7 or 4**



answer consistent with graph e.g. 48(°C) 7
partial e.g. evidence of using the graph (at thermometric property 75) (4)

Question 3 40 marks

An experiment was set up to investigate how the fundamental frequency of a stretched string varied with its length.
The length *l* and the frequency *f* of the string were recorded.

(i) Draw a labelled diagram of the apparatus used in this experiment. **4 × 3**

labelled diagram to show:
string
means of tightening
means of changing frequency e.g. tuning forks / frequency generator
means of varying length e.g. bridge
means of measuring length
means of detecting resonance /paper rider /magnet
detail e.g. sonometer

any four lines 4 × 3

NOTE: no labels, deduct 2, incorrect experiment maximum mark 3× 3

(ii) Indicate on your diagram the length of the string that was measured **6 or 3**

distance between bridges 6
partial answer e.g. reference to bridge (3)

(***iii***) **Describe how the string was set vibrating.** **6 or 3**

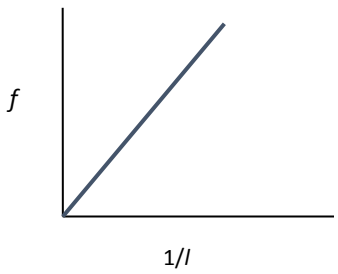
placed a vibrating tuning fork on the bridge // turned on frequency generator 6
partial answer e.g. pluck it / using a tuning fork (3)

(***iv***) **How was the frequency of the string determined?** **7 or 4**

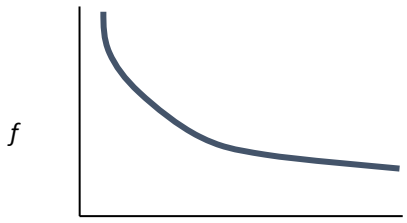
(read the value) from the tuning fork/ frequency generator 7
partial answer (4)

(***v***) **Sketch a graph to show the relationship between *l* and *f* that you would expect to obtain.** **9 or 6 or 3**

f versus 1/*l*



f versus *l*



9

graph with one error (6)

partial answer e.g. graph with one axis correctly labelled (3)

Question 4 40 marks

An experiment was set up to find the resistivity of the material of a wire.

(*i*) **Draw a labelled diagram of the apparatus used in this experiment.** **6 +2 × 3**

labelled diagram to show:

length of wire 6

means of measuring resistance 3

means of measuring length/diameter/cross-sectional area 3

NOTE: no labels, deduct 2, incorrect experiment maximum mark 3× 3

(*ii*) What measurements were taken during this experiment? **12 or 9 or 6 or 3**

length

resistance

diameter /cross-sectional area

three correct 12

two correct (9)

one correct (6)

partial answer e.g. ohmmeter / micrometer (3)

(*iii*) How were these measurements used to calculate the resistivity? **9 or 6 or 3**

$\frac{RA}{l}$ 9

one error in formula (6)

partial answer e.g. substitute the measurements into the formula (3)

(*iv*) State two precautions which the student might have taken to improve the accuracy of this experiment. **7 or 4**

remove kinks from wire

repeat the diameter measurement / take many readings (and get an average)

use a long length

ensure the resistance of the leads connecting to the ohmmeter is low

check for zero error in micrometer, etc.

any line merits (4) any two lines 7

SECTION B (280 Marks)

Five questions to be answered

Question 5 **any *eight* parts** **56 marks**

Take the best 8 from 10 parts

(*a*) State Newton's first law of motion. **7 or 4**

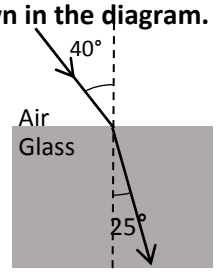
a body will remain at rest or moving at a constant velocity unless an external force acts on it. 7

partial answer (4)

(*b*) Calculate the refractive index of the glass block shown in the diagram. **7 or 4**

n= $\frac{\sin i}{\sin r} = \frac{\sin(40)}{\sin(25)} = 1.52$ 7

partial answer (4)



(*c*) Choose from the list below the instrument used to measure (*i*) energy and (*ii*) resistance. **7 or 4**

barometer **(i) joulemeter** **lens** **(ii) ohmmeter** 7

one correct. (4)

(*d*) State one use for a semiconductor diode. **7 or 4**

allows current flow in one direction, rectifier, LED, switches, p.s.u., etc. 7

partial answer (4)

(*e*) State one use for the instrument shown. **7 or 4**

measure angles/ measure wavelength of light / demonstrate interference / demonstrate diffraction / demonstrate spectra / demonstrate monochromatic light , etc. 7

partial answer (4)

(*f*) Define capacitance. **7 or 4**

$C = \frac{q}{V}$ 7

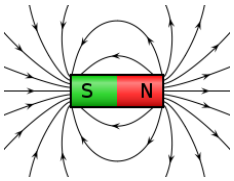
partial answer (4)

(*g*) State two characteristics of a musical note. **7 or 4**

loudness, amplitude, pitch, frequency, overtone, timbre/quality any two 7

any one (4)

(*h*) Sketch the magnetic field around a bar magnet. **7 or 4**



magnet, two field lines, correct direction on lines 7

partial answer e.g. incomplete diagram (4)

(*i*) Name two sources of ionising radiation. **7 or 4**

sun, cosmic, named radioactive element, nuclear weapons, nuclear power plants, etc. any two 7

any one (4)

(*j*) State one application of the photoelectric effect. **7 or 4**

solar panels, burglar alarms, automatic doors, control of burners in central heating, soundtrack in films, etc. one correct 7

partial answer e.g. definition (4)

Question 6 56 marks

Define (*i*) momentum and (*ii*) kinetic energy. **2(6 or 3)**

(i) mass(multiplied) by velocity / $p = mv$ 6

partial answer (3)

(ii) *kinetic energy*: energy due to motion //$\frac{1}{2}mv^2$ 6

partial answer (3)

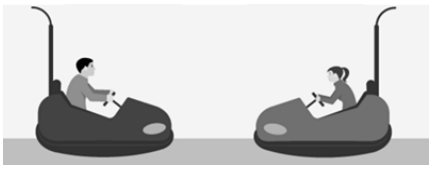
The cannon recoils when a cannon ball is shot from it.

Use the principle of conservation of momentum to explain why the cannon recoils. **6 or 3**

cannon recoils to ensure the momentum after is zero //to conserve momentum /momentum before collision = momentum after collision 6

partial answer (3)

Bumper car A of mass 500 kg is moving with a speed of 6 m s^{-1} when it collides with stationary bumper car B of mass 300 kg. After the collision the cars move together.



(*i*) Calculate the momentum of each car before the collision. **6+3**

$p_A = m_A v_A = (500)(6) = 3000$ kg m s^{-1}

$p_B = m_B v_B = (300)(0) = 0$ kg m s^{-1}

any line merits (6) two lines 6+3

partial answer (3)

(*ii*) What is the momentum of the combined cars after the collision? **6 or 3**

$(m_A + m_B)V = m_A v_A + m_B v_B = 3000$ kg m s^{-1} 6

partial answer e.g. momentum before = momentum after (3)

(*iii*) Calculate the speed of the two cars after the collision. **6 or 3**

$(m_A + m_B)V = m_A v_A + m_B v_B = 3000$ kg m s^{-1}

(500+300) $V = 3000$ $\Rightarrow V = 3.75$ m s^{-1} 6

partial answer (3)

(*iv*) Calculate the kinetic energy of each car before the collision. **6 + 3**

$\frac{1}{2}mv^2 = \frac{1}{2}(500)(6)^2 = 9000$ J

$\frac{1}{2}mv^2 = \frac{1}{2}(300)(0)^2 = 0$ J

any line merits (6) two lines 6 + 3

partial answer (3)

(*v*) Calculate the kinetic energy of the cars after the collision. **5 or 3**

$\frac{1}{2}MV^2 = \frac{1}{2}(500+300)(3.75)^2 = 5625$ J 5

partial answer e.g. 3516 J, 2109 J (3)

(*vi*) What conclusion can be drawn from the change in kinetic energy that happens during the collision? **3**

kinetic energy is not conserved / kinetic energy is lost // answer consistent with (*iv*) and (*v*) 3

Question 7 56 marks

The temperature of an object can be measured using a thermometer.

(*i*) What is heat? **6 or 3**

(a form of) energy / $mc\Delta\vartheta$ /ml 6

partial answer e.g. it is measured in joules (3)

(*ii*) What is meant by the temperature of an object? **6 or 3**

degree of hotness // measurement of hotness/coldness 6

partial answer e.g. it is measured in °C (3)

(*iii*) What is the unit of temperature on the SI scale? **6 or 3**

kelvin / K 6

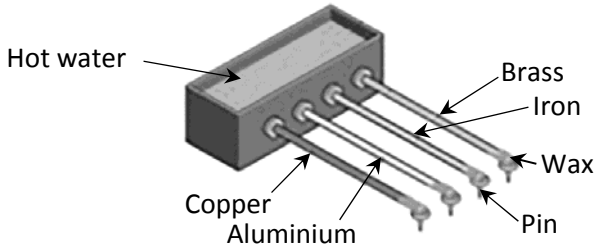
partial answer e.g. °C / F (3)

(*iv*) Express 20 °C in the units you have named in part *(iii)*. **6 or 3**

273+20 = 293 K 6

partial answer e.g. refers to 273 (3)

The diagram shows an apparatus used to compare heat transfer in different metals.



(*v*) Name the method by which heat is transferred in metals. **6 or 3**

conduction // vibrating atoms (transfer energy) 6

partial answer e.g. example (3)

(v*i*) Name the two other methods of heat transfer. **2 × 3**

convection, radiation 2 × 3

partial answer e.g. example (3)

(*vii*) How can this experiment be used to find out which metal is the best at allowing heat transfer? **6 or 3**

the pin which falls first indicates the best conductor 6

partial answer e.g. incomplete answer (3)

(*viii*) State two ways of making sure that this investigation is fair. **2 × 4**

ensure that there is only one independent variable

ensure there is an equal amount of heat for each metal

ensure that the metal strips are the same length / diameter

ensure to have the same amount of wax, etc.

any line merits (4) two lines 2 × 4

(*ix*) Metals are good conductors. Name a good insulator. **6 or 3**

any named insulator e.g. paper, plastic, wood, etc. 6

partial answer e.g. non metal (3)

Question 8 56 marks

Diffraction and interference are properties associated with waves.

(*i*) Explain the underlined terms. **2(6 or 3)**

diffraction is the bending/spreading out of waves around a barrier / the edges of an opening // correct diagram 6

partial answer e.g. light spreads out, bending (3)

interference occurs when two waves meet and add // correct diagram 6

partial answer (3)

reversed explanations (6)

(*ii*) Describe an experiment to demonstrate the wave nature of light. **6 + 2 × 3**

apparatus: (diffraction) grating / Young's slits / CD 6

procedure: shine the light through the grating /Young's slits / CD 3

observation/conclusion; pattern on screen / pattern observed 3

incorrect experiment maximum mark 2 × 3

marks may be obtained from a diagram

accept valid alternatives

The photograph shows a liquid crystal display (LCD) monitor, which may require a Polaroid panel to allow the image on the screen to be seen clearly.

(*iii*) What is meant by polarisation? **6 or 3**

polarisation is the restriction of (vibrating electromagnetic) waves to a single plane 6

marks may be obtained from a diagram

partial answer (3)

(*iv*) Describe an experiment to demonstrate the polarisation of light. **4 × 3**

apparatus: (two pieces of a) polaroid sheet 3

procedure: look at the light through the two pieces of polaroid 3

rotate one of the polaroid pieces 3

observation/conclusion; the crossed pieces stop the light 3

marks may be obtained from a diagram

accept valid alternatives

Monitors of the kind shown use only three colours to form any image.

(*v*) What three colours are used? **3 × 3**

red, green, blue 3 × 3

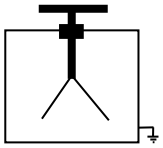
partial answer e.g. the primary colours (3)

(*vi*) Describe how these colours can be used to create any image. **5 or 3**

these colours may be mixed (to give white light/ other colours) 5

partial answer (3)

Question 9 56 marks



(*a*) The diagram shows a positively charged gold leaf electroscope.

(*i*) State Coulomb's law of force between charges. **2 × 3**

force proportional to the product of charges / $F \propto Q_1Q_2$ 3

inversely proportional to the distance between the charges squared / $\propto \frac{1}{r^2}$ 3

partial answer (3)

(*ii*) State one use of an electroscope. **3**

test for charge, identify charge, measure potential, etc. 3

(*iii*) How can an electroscope be given a positive charge? **6 or 3**

touch the cap with a positively charged conductor //
bring the(negatively) charged rod close to the cap and earth remove the earth before removing the rod 6
accept valid alternatives e.g. Van De Graaff
labelled diagrams may merit full marks
partial answer (3)

(*iv*) What is observed when the cap of a charged electroscope is earthed? **3**

the leaves collapse/converge / fall 3

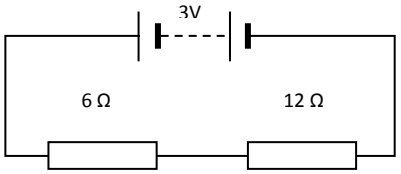
(*v*) Explain this observation. **6 or 3**

charges move (between the earth and the cap) // no (excess) charge 6
partial answer (3)

(*vi*) How could the cap of the electroscope be earthed? **4**

by touching with a conductor / finger 4

(*b*) The circuit diagram shows two resistors connected in series with a 3 V battery.



(*i*) State Ohm's law. **6 or 3**

the current through a conductor is directly proportional to the voltage / $V=IR$ 6
partial answer (3)

(*ii*) Calculate the total resistance of the circuit. **6 or 3**

(6 + 12 =) 18 Ω 6
partial answer (3)

(*iii*) Calculate the current in the circuit. **6 or 3**

$I = \frac{V}{R}$ = 0.166 A 6
partial answer e.g. $I = \frac{V}{R}$ (3)

(*iv*) Calculate the potential difference across the 6 Ω resistor. **6 or 3**

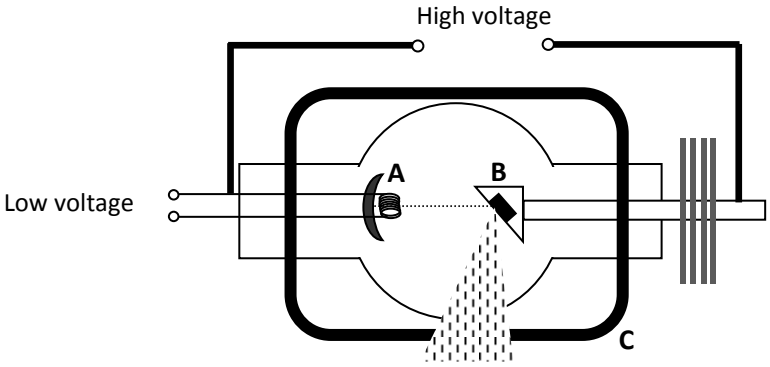
($V = IR$ = (0.166)(6) =) 1 V 6
partial answer e.g. $V = IR$ (3)

(*v*) Name an instrument used to measure potential difference. **4 or 2**

voltmeter /multimeter 4
partial answer (2)

Question 10 56 marks

X-rays are produced when a beam of high speed electrons collides with a target in a tube like the one shown.



(*i*) What are X-rays? State two properties of X-rays. **2(6 or 3)**

electromagnetic waves // high energy radiation 6
partial answer e.g. stated property such as ionisation / radiation (3)

short wavelength, cause ionisation, affect photographic plates, absorbed by bone/metal, no charge, etc. any one merits (3) any two 6
partial answer e.g. reference to photograph / medicine / industry, etc. (3)

(*ii*) What process occurs at part A? **6 or 3**

thermionic emission // release of electrons // heating 6
partial answer (3)

(*iii*) Name a substance used in part B. **4 or 2**

tungsten, molybdenum, named metal 4
partial answer (2)

(*iv*) State the function of part C. **6 or 3**

prevent escape of X-rays, shielding, protect (from X-rays), etc. 6
partial answer e.g. maintain a vacuum (3)

(*v*) State one use of X-rays. **4 or 2**

to photograph bones/ internal organs, to treat cancer, to detect flaws in materials, to determine the thickness of materials, etc. any one 4
partial answer e.g. reference to photograph / medicine / industry, etc. (2)

(*vi*) Why is a vacuum needed inside an X-ray tube? **6 or 3**

so the electrons won't collide and lose energy // allow electrons to speed up more efficiently 6
partial answer (3)

(*vii*) Name another device that uses a beam of high speed electrons. **6 or 3**

cathode ray tube, fluorescent light 6
partial answer (3)

(*viii*) State one use for the device you have named in part (*vii*). **6 or 3**

CRO, medical devices, (old) TVs/screens 6
partial answer (3)

(*ix*) State one difference between X-rays and gamma-rays. **6 or 3**

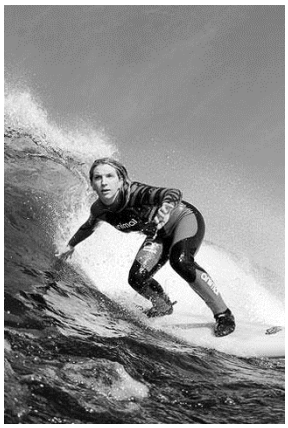
different ways of production, different energy / wavelength /frequency / penetration / ionising/ etc. any one 6
partial answer (3)

Question 11 56 marks

Read the following passage and answer the questions below.

The Physics of Surfing

Many people are surprised to learn that there is a lot of physics involved in riding a wave. Consider the principle of the wave itself: the energy of offshore storms is transmitted in ocean waves. As the ocean waves move into shallow water they slow down, the wavelength decreases and the wave height (amplitude) increases until the wave becomes unstable and breaks.



A vital physical principle behind surfing is Archimedes' principle, which keeps the board floating and allows the surfer to ride the wave. Archimedes' principle states that *when a body is floating in a fluid it displaces its own weight of the fluid*. The buoyancy (upthrust) counterbalances the weight of both the surfboard and the surfer and prevents both from sinking. Since the weight of the surfer is distributed evenly by the surfboard and is counterbalanced by the board's buoyancy, the surfer can stand on the top of the water.

The weight of the surfer on the board produces a force that is straight down. At the same time, buoyancy produces a force that acts on the board. This force, together with forces due to the wave, pushes the surfer forward. The sum of these forces results in a forward force that propels the surfer in the same direction as the wave.

Adapted from *http://illumin.usc.edu/index/article/193/the-engineering-behind-surfing/* (University of Southern California)

(*a*) What physical quantity is transmitted in a wave? **7 or 4**

energy 7

partial answer (4)

(*b*) Why do waves break close to the shore? **7 or 4**

the wavelength decreases and the wave height (amplitude) increases // waves move into shallow water until the wave becomes unstable and breaks 7

partial answer e.g. as waves move into shallow water they slow down (4)

(*c*) Draw a diagram to show the main features of a wave. **7 or 4**

7

diagram to include
wave shape
wavelength /amplitude /crest /trough etc.

partial answer (4)

(*d*) State Archimedes' principle. **7 or 4**

when a body is immersed in a fluid , the upthrust it experiences is equal to the weight of the fluid displaced //when a body is floating in a fluid it displaces its own weight of the fluid 7

partial answer (4)

(*e*) What is meant by the term buoyancy (upthrust)? **7 or 4**

an upward force exerted by a fluid 7

partial answer (4)

(*f*) How does buoyancy help the surfer to stay afloat? **7 or 4**

counterbalances the weight 7

partial answer (4)

(*g*) Draw a labelled diagram to show the forces acting on a floating object. **7 or 4**

diagram to show: weight down, upthrust up, forward force any two 7

partial answer e.g. one force shown (4)

(*h*) Explain how the stance of the surfer shown helps her to balance. **7 or 4**

low centre of gravity // wide stance 7

partial answer (4)

Question 12 56 marks

Answer any two of the following parts (*a*), (*b*), (*c*), (*d*).

(*a*) Define (*i*) velocity and (*ii*) acceleration. **2(5 or 3)**

(*i*) displacement per second / $v = \frac{s}{t}$ 5

partial answer (3)

(*ii*) change in velocity per unit time /$a = \frac{v-u}{t}$ 5

partial answer (3)

A train left a station and accelerated from rest at 0.4 m s^{-2} to reach its top speed of 55 m s^{-1}. The train then travelled for 300 seconds at this speed.

(*iii*) Calculate how long it took the train to reach its top speed. **6 or 3**

(t = $\frac{v-u}{a} = \frac{55-0}{0.4}$ =) 137.5 s 6

partial answer e.g. $v = u + at$ (3)

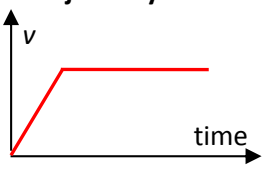
(*iv*) How far did the train travel while at its top speed? **6 or 3**

[$s=vt$ =(300)(55) =] 16500 m 6

partial mark e.g. $s= vt$ (3)

(*v*) Draw a velocity-time graph of the train's journey. **6 or 3**

correct shape with axes 6



partial answer (3)

(*b*) Sunlight is made up of visible light of different colours as well as many types of invisible radiation.

(*i*) How could you show the different colours present in visible light? **6 + 3**

apparatus: (white light source, screen), prism/CD/grating 6

shine the light through the prism/CD/grating 3

partial answer (3)

marks may be obtained from a diagram

accept valid alternatives

(*ii*) UV radiation is also present in sunlight.

What do the letters U and V stand for? **6 or 3**

ultraviolet 6

partial answer (3)

(*iii*) Compare the wavelength of UV radiation to the wavelength of infra-red (IR) radiation. **3**

ultraviolet has a shorter wavelength 3

(*iv*) Describe how to detect UV radiation. **6 or 3**

florescent material will fluoresce/glow 6

partial answer (3)

accept valid alternatives

a labelled diagram may merit full marks

(*v*) State one use of UV radiation. **4 or 2**

detect forged currency, disco lights, used in insect removal device, sterilisation, suntan, forensics, etc. 4

partial answer (2)

(*c*) The diagram shows a water boiler which is filled with 0.7 kg of water which is initially at 20 °C. The boiler has a power rating of 3 kW.

(*i*) Calculate the energy needed to raise the temperature of the water from 20 °C to 90 °C. **12 or 9 or 6 or 3**

$E = mc\Delta\vartheta$ = (0.7)(4200)(90-20) = 205800 J	12
one error	(9)
two errors	(6)
partial answer e.g. correct formula	(3)

(*ii*) How many joules of energy are supplied per second by the boiler? **4 or 2**

3000	4
partial answer e.g. 3	(2)

(*iii*) Calculate how long it will take the boiler to heat the water to 90 °C. **6 or 3**

$E = Pt \quad \Rightarrow t = \frac{E}{P} = \frac{205800}{3000}$ = 68.6 s	6
partial answer	(3)

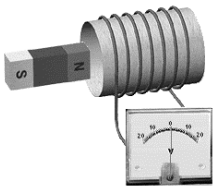
(*iv*) Where should the manufacturer place the heating element of the boiler? Explain your answer. **2 × 3**

at the bottom	3
hot water (is less dense and) rises	3
partial answer	(3)

(*d*) (*i*) What is electromagnetic induction? **2 × 3**

emf / voltage / potential difference / current is induced	3
(due to)changing (magnetic) flux / field // moving magnet	3
partial answer	(3)

a diagram or example may merit full marks



(*ii*) Explain how you would use a magnet and a coil, as shown above, to produce electricity. **6 or 3**

move the magnet into/out of the coil	6
partial answer	(3)

(*iii*) How would you know that electricity is being produced? **6 or 3**

deflection /pointer moves / from the meter	6
partial answer	(3)

(*iv*) How could you increase the magnitude of the electricity produced? **6 or 3**

move faster / use a stronger magnet / use more coils	6
partial answer	(3)

(*v*) The apparatus in the diagram can be used to produce a.c. electricity. What is meant by a.c.? **4 or 2**

alternating current	4
partial answer	(2)