

Y12 Transition Work: Exam Practice Booklet
MARK SCHEME

Mark schemes

Q1.

- (a) transfer of electrons
mention of positive charge moving negates both marks 1
- from the carpet to the student 1
- (b) three arrows perpendicular to sphere's surface with all arrows directed inwards and distributed evenly around sphere 1
- (c) there is a potential difference between the student and the tap
*do **not** accept the tap / sink is charged* 1
- which causes electrons / charges to transfer from the student
or
 which causes electrons / charges to transfer to the tap 1
- which earths the charge
allow the tap is earthed 1
- (d) carpet / copper has a low resistance
allow carpet is a conductor
or
copper is a conductor 1
- lower / no build-up of charge (on the student)
or
 (so there is a) smaller / no potential difference between student and tap / earth 1

[8]

Q2.

- (a) The particles move in random directions. 1
- The particles move with a range of speeds. 1
- (b) $100\,000 \times 0.030 = 3000$ 1
- $p \times 0.025 = 3000$
allow a correct substitution using an incorrectly calculated value using $pV = \text{constant}$ 1

$$p = \frac{3000}{0.025}$$

allow a correct rearrangement using an incorrect value of the constant

1

$$p = 120\,000 \text{ (Pa)}$$

*allow a correct calculation using an incorrect value of the constant
allow correct substitution into $p_1V_1 = p_2V_2$ for first 2 marking points*

1

- (c) particles would have a higher (mean) kinetic energy

*allow particles would have a higher (mean) speed
do not accept particles vibrate more*

1

(so) increased number of collisions with the walls of the balloon per second

allow greater frequency of collisions with the walls of the balloon

1

greater forces exerted in collisions (between particles and balloon walls)

allow greater rate of change of momentum (of particles)

1

greater force exerted on same area

allow description using $p=F/A$

1

[10]

Q3.

- (a) smoke absorbs / stops alpha radiation

*allow alpha particles for alpha radiation
alpha radiation does not reach the detector is insufficient*

1

- (b) alpha radiation is not very penetrating

allow alpha particles for alpha radiation

or

alpha radiation does not penetrate skin

allow alpha radiation does not travel very far (in air)

1

- (c) beta and gamma radiation will penetrate smoke

allow beta and gamma radiation will not be stopped by smoke

1

no change (in the count rate) would be detected

allow the change detected (in the count rate) would be too small

1

- (d) (a long half-life means) the count rate is (approximately) constant

allow activity of source is (approximately) constant

or

a short half-life means the count rate decreases quickly

1

until 1.3 half-lives the count rate is above 80 per second

allow after 1.3 half-lives the count rate is below 80 per second

or

until 1.3 half-lives the count rate is above the threshold for the smoke alarm to be activated

or

after 1.3 half-lives the smoke alarm will be activated all the time

so don't have to replace source or smoke detector is insufficient

1

- (e) **Level 2:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.

3-4

Level 1: Relevant points (reasons / causes) are identified, and there are attempts at logically linking. The resulting account is not fully clear.

1-2

No relevant content

0

Indicative content

- short half-life or half-life of a few hours
- (short half-life means) less damage to cells / tissues / organs / body
- low ionising power
- (low ionising power means) less damage to cells / tissues / organs / body
- highly penetrating
- (highly penetrating means) it can be detected outside the body
- emits gamma radiation

[10]

Q4.

- (a) Any **one** from:

- (medical) x-rays
allow CT scans
- radiotherapy
- nuclear weapons (testing)
allow nuclear fallout
- named nuclear disaster e.g. Chernobyl / Fukushima / Three Mile Island.
ignore radioactive / nuclear waste

1

- (b) uranium / plutonium

*ignore any number given
allow thorium*

1

- (c) neutron absorbed by a uranium nucleus 1
- nucleus splits into two parts
allow an atom splits into two parts if 1st marking point doesn't score 1
- and (2/3) neutrons (are released) 1
- and gamma rays (are emitted) 1
- (d) lighter nuclei join to form heavier nuclei
allow specific examples 1
- some of the mass (of the nuclei) is converted to energy (of radiation) 1
- (e) activity decreases quickly
allow nuclei / waste will decay at a greater rate
ignore waste is radioactive for less time 1
- risk of harm decreases quickly
allow burial site doesn't need to be monitored for as long
or
doesn't need to be buried underground for as long
or
may not need to be buried underground 1
- [10]**

Q5.

- (a) 60
allow 1 mark for correct substitution (with d in metres),
ie $36 = F \times 0.6$
an answer of 0.6 or 6 gains 1 mark 2
- (b) the line of action of the weight lies outside the base / bottom (of the bag)
accept line of action of the weight acts through the side
accept the weight (of the bag) acts outside the base / bottom
(of the bag) 1
- a resultant / overall / unbalanced moment acts (on the bag)
accept the bag is not in equilibrium
*do **not** accept the bag is unbalanced* 1

[4]

Q6.

(a) upthrust acts upwards 1

normal contact force acts upwards 1

weight – (upthrust + normal contact force) = 0
allow resultant force equal to zero only if all three forces and correct direction are given 1

(b) $A = 0.25 \times 0.10 = 0.025 \text{ m}^2$ 1

$P = \frac{637}{0.025}$
allow correct substitution of incorrectly calculated value of A 1

$P = 25\,480 \text{ Pa}$
allow correct calculation using and incorrectly calculated value of A
to gain further marks, $P = F/A$ must have been used 1

$25\,480 = 2.5 \times \rho \times 9.8$
allow correct substitution of incorrectly calculated value of P 1

$\rho = \frac{25\,480}{9.8 \times 2.5}$
allow correct rearrangement using an incorrectly calculated value of P 1

$\rho = 1040 \text{ kg/m}^3$
allow correct calculation using an incorrectly calculated value of P 1

(c) force = $618 \times \frac{49.9}{2.5}$ 1

force = 12 3335.28
this answer can score the first 2 marks 1

force = 12 300 (N)
allow max of 2 marks if 50 m is used
full credit can be given if ρ is calculated: $\rho = 1009$

kg/m^3

1

[12]

Q7.

- (a) (total) momentum before = (total) momentum after
allow (total) momentum stays the same

1

- (b) momentum of player A = 585 (kg m/s)

1

momentum of player B = -500.5 (kg m/s)

1

$$\frac{(-500.5 + 585)}{(78 + 91)}$$

OR

$$\frac{84.5}{169}$$

allow $\frac{1085.5}{169}$

1

= 0.5 (m/s)

this answer only

1

- (c) (protective pads) increase the time taken to stop (during the collision)
allow increases impact / contact / collision time
do not allow slows down time

1

so the rate of change of momentum decreases

allow reduces acceleration/deceleration

allow increases the time to reduce the momentum to zero for 2 marks

1

reducing the force (on the ice hockey player)

allow impact for force

do not allow if linked to an incorrect explanation

1

[8]

Q8.

- (i) (partly) reflected when they hit a (boundary between two) different media or substance or tissue

accept named substances

do not accept bounce back

time taken for reflected wave (to return) is used to produce the image

1

(ii) any **one** from:

cleaning a delicate mechanism / jewellery

do not accept cleaning

welding plastics

cutting textiles

mixing emulsion paints

sonar

motion sensors (in burglar alarms)

do not accept burglar alarms

removing dental plaque

industrial quality control

breaking up kidney stones

treating injuries

1

[3]

Q9.

(a) focal length

this answer only

1

(b) one correct line drawn from the top of the object, passing through the lens and crossing or meeting given line

ignore any arrow drawn on the line

if two lines are drawn, both must be correct

1

inverted image drawn at the correct position and length

arrowhead required

1

(c) similarity
(both are) diminished

1

difference

concave is virtual and convex is real

or

concave is upright and convex is inverted

allow smaller for diminished

*a comparison must be made
ignore reference to positions of images*

1

(d)

an answer of 1.5 (mm) scores 3 marks

$$6.0 = \frac{9.0}{\text{object height}}$$

1

$$\text{object height} = \frac{9.0}{6.0}$$

1

$$\text{object height} = 1.5 \text{ (mm)}$$

*provided working can be seen, an attempt to
convert 9.0 mm to cm or m with all other steps
correct scores 2 marks*

1

[8]

Q10.

- (a) light (inside the tin can) is reflected many times before
incident on the hole

1

at each reflection energy / light is absorbed so (very) little
light / energy leaves the hole

1

- (b) the object absorbs all of the radiation incident on it
or
the object does not reflect or transmit any radiation
or
the object is the best possible emitter of radiation

1

- (c) the intensity of every wavelength increases

1

the shorter the wavelength the more rapid the increase in
intensity

1

the peak intensity occurs at shorter wavelength

1

- (d) accept any value between 1600 (°C) and 10 000 (°C)

1

- (e) the temperature has increased

1

as 200 years ago the energy / radiation from space = energy
/ radiation emitted (and reflected) into space

but now less radiation is emitted so there is a net absorption
allow energy for radiation

1

[10]

Q11.

(a) (i) generator

1

(ii) alternating current

1

(iii) voltmeter / CRO / oscilloscope / cathode ray oscilloscope

1

(b) (i) time

1

(ii) peaks and troughs in opposite directions

1

amplitude remains constant

dependent on first marking point

1

(c) any **two** from:

- increase speed of coil
- strengthen magnetic field
- increase area of coil

do not accept larger

2

[8]

Q12.

(a) motor (effect)

1

(b) current creates a magnetic field (around the coil)

1

(which) interacts with the permanent magnet field

1

producing a (resultant) force causing the coil/cone to move

1

(when the) direction of the current reverses, the direction of the (resultant) force reverses (producing a sound wave)

allow coil/cone for force allow backwards for reverses

1

- (c) the student changed two variables at the same time
allow only one variable should be changed at a time

1

(so) it is not possible to know the effect of each variable

1

[7]

Q13.

- (a) It is easily magnetised.
- (b) p.d. across the secondary coil is smaller (than p.d. across the primary coil)
- (c) ratio $\frac{V_s}{V_p} = \frac{6}{50}$
 $V_s = 12$
accept any other correct ratio taken from the graph

1

1

1

$$\frac{6}{12} = \frac{50}{N_p}$$

$$N_p = 100$$

use of the correct turns ratio and substitution or correct transformation and substitution

1

$$N_p = 100$$

allow 100 with no working shown for 3 marks

1

[5]

Q14.

- (a) (force of) gravity
do not allow weight

1

fusion

1

- (b) distance = speed \times time
allow a correct re-arrangement

or

$$s = vt$$

do not allow $d = st$

1

- (c) $1.5 \times 10^{11} = 3.0 \times 10^8 \times t$

1

$$t = \frac{1.5 \times 10^{11}}{3.0 \times 10^8}$$

1

$$t = 500 \text{ (s)}$$

1

(d) **Level 3:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.

5-6

Level 2: Scientifically relevant facts, events or processes are identified and their relevance is clear. The account is not fully accurate.

3-4

Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.

1-2

No relevant content

0

Indicative content:

- fusion (processes in stars) produce new elements
- cloud of gas / hydrogen **and** dust **OR** nebula
- pulled together by gravity
- causing increasing temperature (to start the fusion process)
- (to become a) protostar
- hydrogen nuclei fuse to form helium nuclei
- and the star becomes main sequence
- hydrogen begins to run out
- helium nuclei fuse to make heavier elements
- up to iron
- the star expands (to become a)
- red super giant
- (the star collapses rapidly) and explodes
- called a supernova
- creating elements heavier than iron
- and distributing them throughout the universe
- leaving behind a neutron star
- or a black hole.

(e) Temperature

1

[13]

Q15.

(a) wavelength

allow a correct answer indicated in the box provided the answer space is blank

1

(b) C

1

(d) Very dense and extremely hot

1

1

(e) Scientific evidence supports the theory

1

(f) Z

1

any **one** from

- (only one) shows the universe is expanding
- (only one) shows the universe began (very) small

only scores if Z is chosen

1

[7]