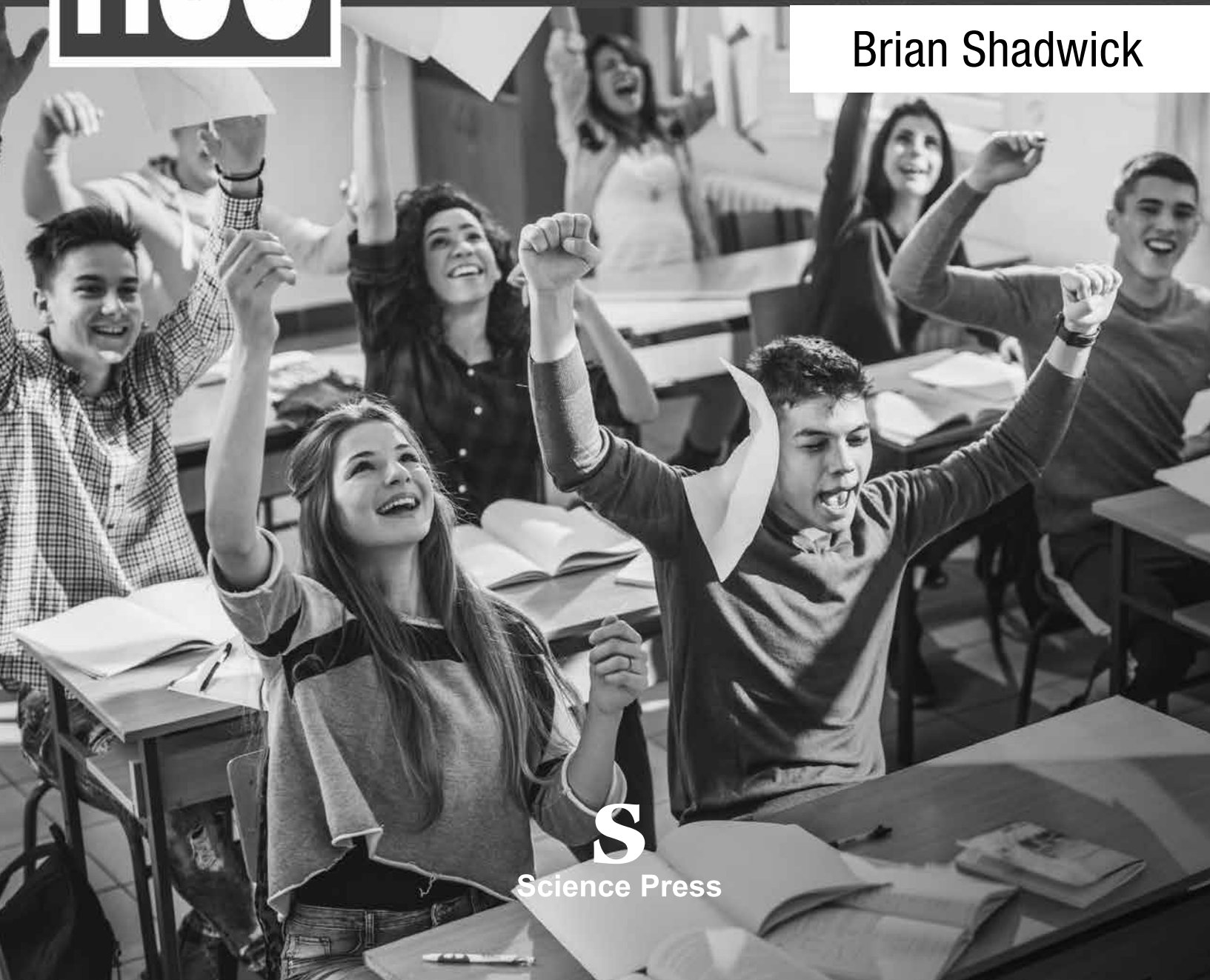
Mastering Physics

HSC

Sample Exam Papers and Answers

Brian Shadwick



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Words to Watch

account, account for State reasons for, report on, give an account of, narrate a series of events or transactions.

analyse Interpret data to reach conclusions.

annotate Add brief notes to a diagram or graph.

apply Put to use in a particular situation.

assess Make a judgement about the value of something.

calculate Find a numerical answer.

clarify Make clear or plain.

classify Arrange into classes, groups or categories.

comment Give a judgement based on a given statement or result of a calculation.

compare Estimate, measure or note how things are similar or different.

construct Represent or develop in graphical form.

contrast Show how things are different or opposite.

create Originate or bring into existence.

deduce Reach a conclusion from given information.

define Give the precise meaning of a word, phrase or physical quantity.

demonstrate Show by example.

derive Manipulate a mathematical relationship(s) to give a new equation or relationship.

describe Give a detailed account.

design Produce a plan, simulation or model.

determine Find the only possible answer.

discuss Talk or write about a topic, taking into account different issues or ideas.

distinguish Give differences between two or more different items.

draw Represent by means of pencil lines.

estimate Find an approximate value for an unknown quantity.

evaluate Assess the implications and limitations.

examine Inquire into.

explain Make something clear or easy to understand.

extract Choose relevant and/or appropriate details.

extrapolate Infer from what is known.

hypothesise Suggest an explanation for a group of facts or phenomena.

identify Recognise and name.

interpret Draw meaning from.

investigate Plan, inquire into and draw conclusions about.

justify Support an argument or conclusion.

label Add labels to a diagram.

list Give a sequence of names or other brief answers.

measure Find a value for a quantity.

outline Give a brief account or summary.

plan Use strategies to develop a series of steps or processes.

predict Give an expected result.

propose Put forward a plan or suggestion for consideration or action.

recall Present remembered ideas, facts or experiences.

relate Tell or report about happenings, events or circumstances.

represent Use words, images or symbols to convey meaning.

select Choose in preference to another or others.

sequence Arrange in order.

show Give the steps in a calculation or derivation.

sketch Make a quick, rough drawing of something.

solve Work out the answer to a problem.

state Give a specific name, value or other brief answer.

suggest Put forward an idea for consideration.

summarise Give a brief statement of the main points.

synthesise Combine various elements to make a whole.

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Name:

Sample Higher School Certificate Examination

PHYSICS

Paper 1

General Instructions

- Reading time – 5 minutes
- Working time – 3 hours
- Write using black pen
- Draw diagrams using pencil
- Board approved calculators may be used
- A data sheet, formula sheet and periodic table are provided at the back of this book

Total marks: 100

Section 1 – 20 marks (pages 6 to 13)

- Attempt Questions 1 to 20
- Allow about 35 minutes for this section

Section 2 – 80 marks (pages 14 to 26)

- Attempt Questions 21 to 38
- Allow about 2 hours and 25 minutes for this section

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Section I

20 marks

Attempt Questions 1 to 20
Allow about 35 minutes for this part

Use the multiple choice answer sheet below for Questions 1 to 20

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

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

Total correct

/20

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Section I

20 marks
Attempt Questions 1 to 20
Allow about 35 minutes for this section

Use the multiple choice answer sheet for Questions 1 to 20

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1 A DC voltage was applied to a cathode ray tube and it was observed that the cathode rays travelled in a straight line beam which was affected by a magnetic field.

What could be concluded from this observation?

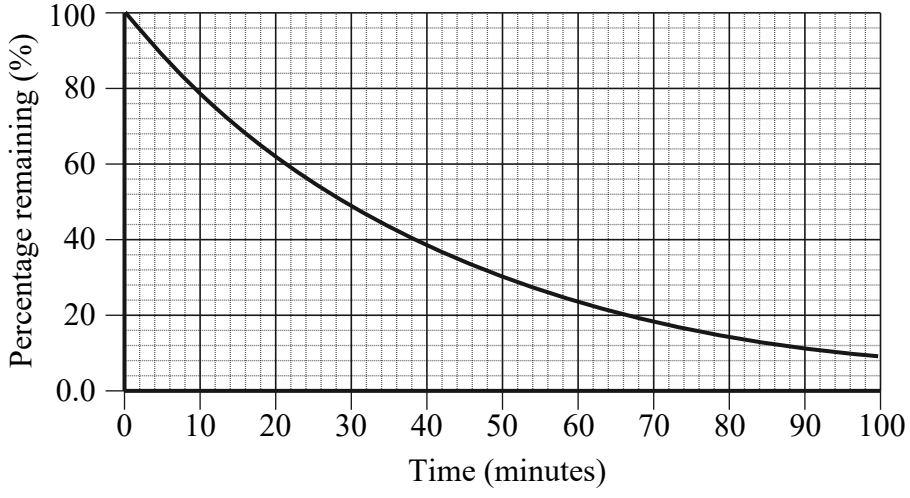
A. Cathode rays must be charged particles.

B. Cathode rays are electrons.

C. Cathode rays will not be affected by an electric field.

D. Cathode rays have very little mass.

2 A sample of radioactive element *X* decayed over time. The graph shows the percentage of element *X* remaining from the initial sample as a function of time.



How much of a 20 g sample of element *X* would remain after an hour?

A. About 2.5 g

B. About 4.8 g

C. About 24 g

D. About 76 g

3 A proton has a mass of 1.67×10^{-27} kg. What is the magnitude of the momentum (in kg m s^{-1}) of a proton travelling at 0.6 *c*?

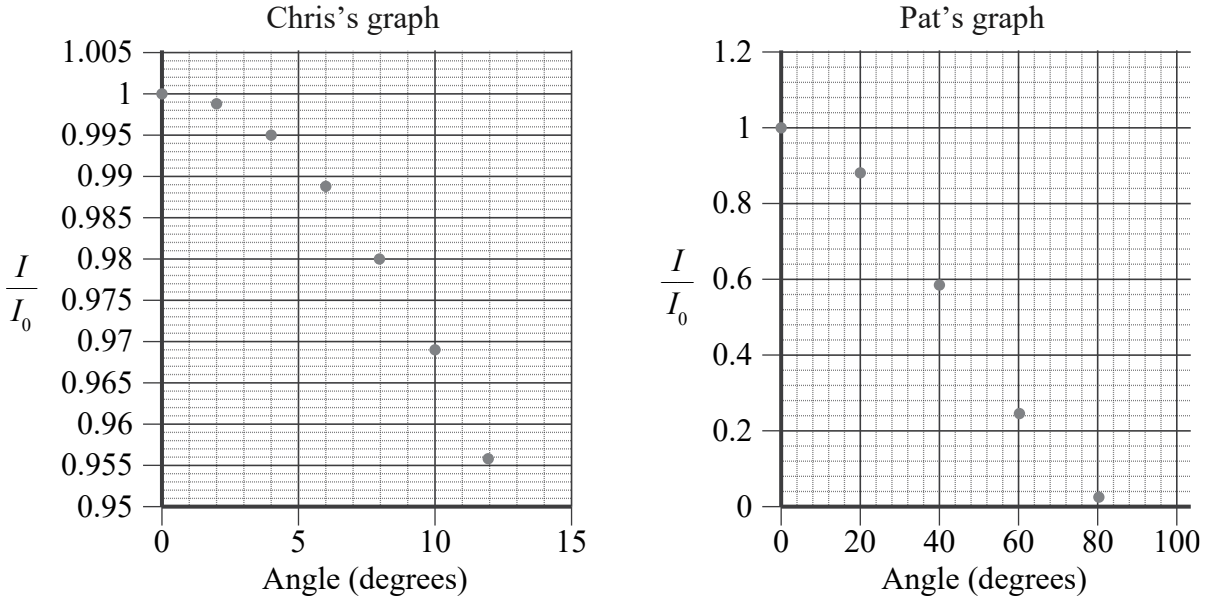
A. 2.71×10^{-11}

B. 3.38×10^{-11}

C. 3.01×10^{-19}

D. 3.76×10^{-19}

4 Chris and Pat carried out independent experiments to investigate Malus' law. They graphed the results of their experiments. The graphs are shown below.



Based on the two graphs, which of the following is correct?

A. Pat's results are more valid because she has covered a greater range of incident angles.

B. Pat's conclusion will be incorrect because her measurements have not been precise enough to show the true relationship.

C. Chris's results are more accurate because the relationship between intensity transmitted and angle is more clearly shown.

D. Chris's results will be more reliable because more data points have been taken.

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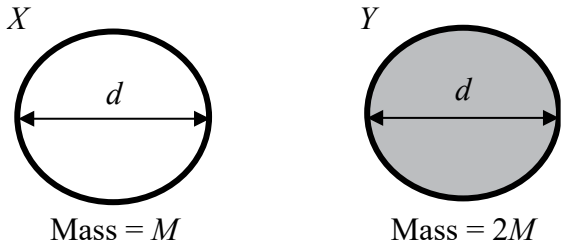
5 Consider the two planets, *X* and *Y* shown below. They are the same size, but *Y* is twice the mass of *X*.



The gravitational field on the surface of *X* is '*g*'. What is the gravitational field on the surface of *Y*?

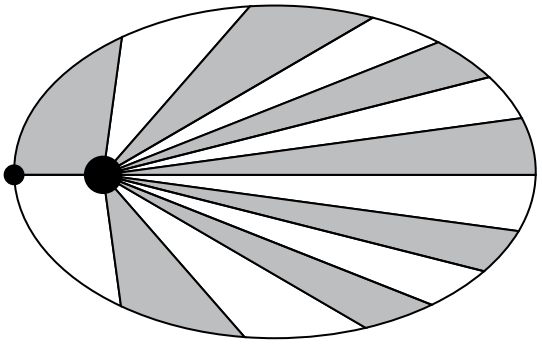
A. 0.25 *g*

B. 0.5 *g*

C. 2 *g*

D. 4 *g*

6 Consider the diagram which shows the path of a planet orbiting a star. According to Kepler, if the arc length of each of the sectors shown represents the same period of time for the orbiting body, then



A. the planet is orbiting with constant speed.

B. the planet travels faster further from the star.

C. the grey and white sectors are all equal area.

D. the grey and white sector areas represent the total distance travelled by the planet in each period of time.

7 A car of mass *m* travels around a curve with velocity *v*. What will happen to the magnitude of the centripetal force if the velocity doubles?

A. It will decrease by a factor of two.

B. It will increase by a factor of two.

C. It will decrease by a factor of four.

D. It will increase by a factor of four.

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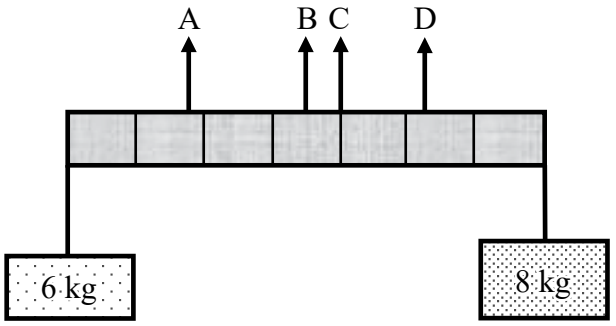
8 Two masses, 6 kg and 8 kg, are hung from the ends of a 70 cm long rod that has marks every 10 cm, as shown in the diagram. Taking the mass of the rod as negligible, at which of the points indicated should a cord be attached if the rod is to remain horizontal when suspended from the cord?



A. A

B. B

C. C

D. D

9 A charge of –6.0 μC experiences a force of 3.6×10^{-5} N south at point *P* when it is placed in an electric field. What is the strength of the electric field at *P*?

A. 0.17 N C^{-1} south

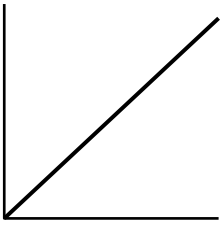
B. 0.17 N C^{-1} north

C. 6 N C^{-1} south

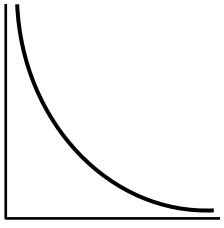
D. 6 N C^{-1} north

10 Which graph best shows the relationship between the force between parallel current carrying conductors and the distance between them?

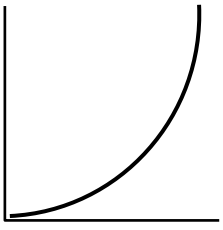
A.



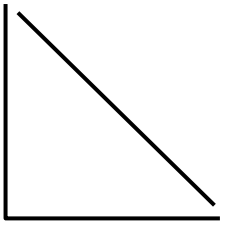
B.



C.



D.



11 A current carrying conductor in a magnetic field experiences a force of *F* newtons. Find the force on it if its length is halved and the current flowing in it is doubled?

A. 0.5*F*

B. *F*

C. 2*F*

D. 4*F*

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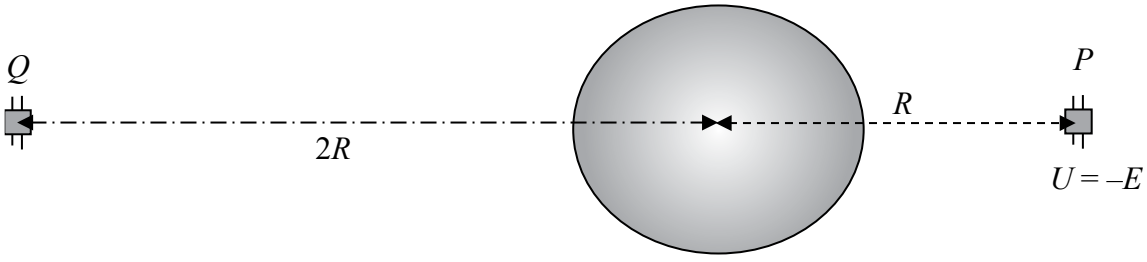
Section 2

80 marks
Attempt Questions 21 to 38
Allow about 2 hours and 25 minutes for this part

Question 21 (3 marks)

A satellite, X, is in orbit around the Earth with an orbital radius of R km, in position P as shown in the diagram. In this position it has $-E$ joules of gravitational potential energy.



Sarah studied this diagram and then stated that moving this satellite to position Q would halve its gravitational potential energy, but this change in potential energy would not equal the work done on it, and therefore she had found an example of a situation which violated the law of conservation of energy. Evaluate Sarah's statement.

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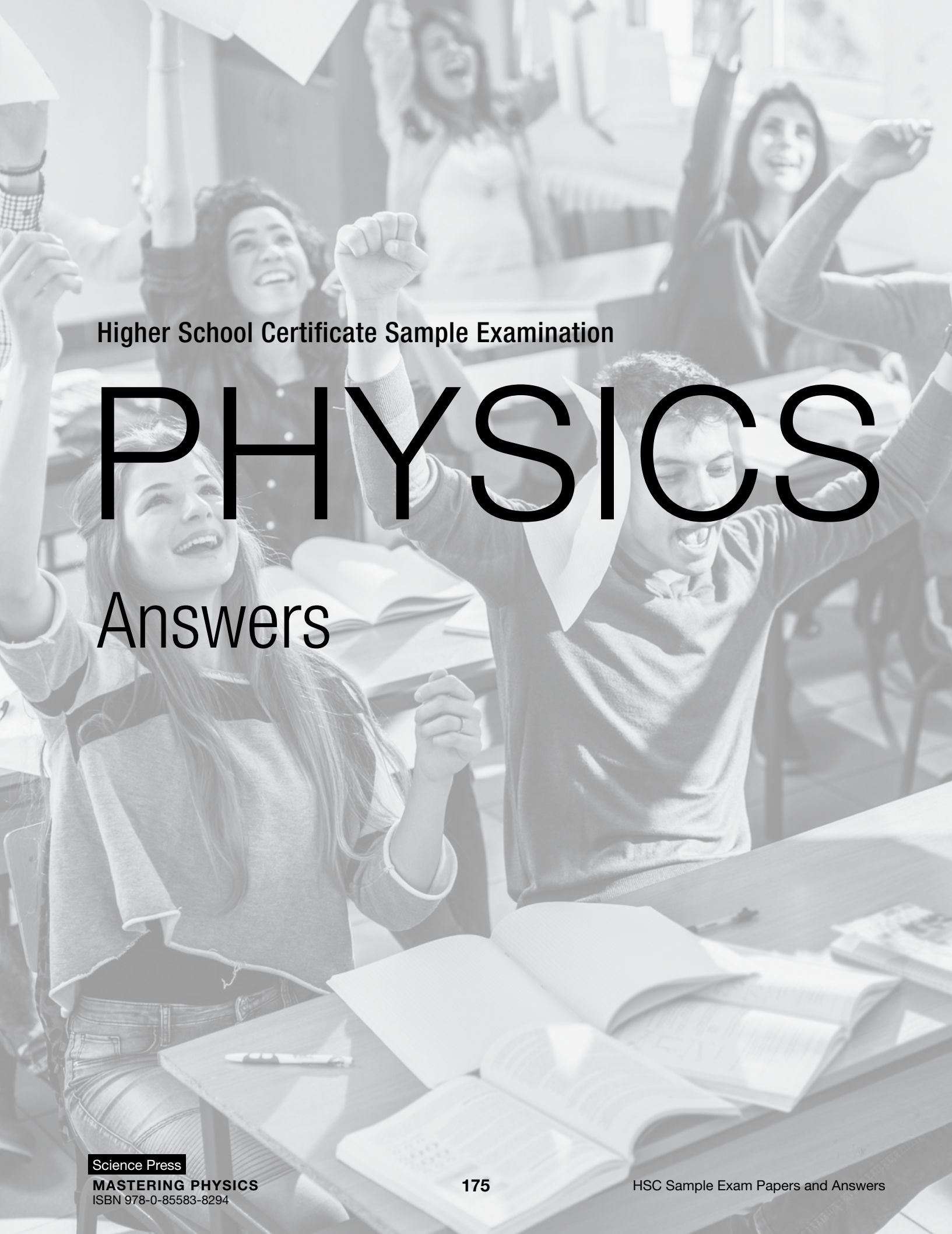

Higher School Certificate Sample Examination

PHYSICS

Answers

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PHYSICS Paper 1

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

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

21 At the new position, the gravitational potential energy of the satellite will be $\frac{-E}{2}$ because gravitational energy is inversely proportional to the orbital radius. This smaller negative value is actually and an increase in the gravitational potential energy of the satellite. Because the satellite moves to a higher orbit, work must be done on it – i.e. energy must be added to the satellite. It is this energy that increases the gravitational potential energy and therefore the law of conservation of energy is not violated. Sarah's statement is invalid.

22 When a vehicle moves round a horizontal curve on a road, the necessary centripetal force needed to keep the car on the road is provided by the friction between the tyres and the road. If the road is banked on the curve, then a component of the normal reaction force on the car acts towards the centre of the curve and adds to the frictional force, therefore allowing the car to travel at a faster speed through the curve.

23 Horizontal component of velocity = 150 cos 60°
= 75 m s^{-1}

Therefore, time of flight = $\frac{300}{75}$ = 4 s

Initial vertical velocity = 150 sin 60° = 129.9 m s^{-1}

Vertical velocity as it hits the cliff 4 s later = $u + at$
= 129.9 – 9.8 × 4
= 90.7 m s^{-1} upwards

From $s = ut + \frac{1}{2}at^2$

= (129.9 × 4) – ($\frac{1}{2}$ × 9.8 × 16)
= 441.2 m above launch point

24 (a) The orbital velocity of a satellite is given by $v_0 = \sqrt{\frac{GM}{r}}$ where M is the mass of the planet being orbited – not the satellites. Therefore, in order to have the same orbital velocity, the only other variable, r must be the same.

(b) Total work done is more than the total energy when in orbit because work done to put into orbit is the sum of its orbital kinetic energy (positive) and the change in gravitational potential energy between the surface and the orbital position (positive) whereas total energy is the orbital kinetic energy (positive) plus the gravitational potential energy relative to the centre of the Earth (negative).

(c) Orbital kinetic energy will be more because in a lower altitude orbit, orbital velocity will be greater.

Gravitational potential energy will be less (greater negative value) because the orbital radius is less.

25 From $F = \frac{GMm}{r^2}$

We get $r = \sqrt{\frac{6.67 \times 10^{-11} \times 150 \times 150}{8.34 \times 10^{-7}}}$

Therefore, r = 1.34 m

26 The diagrams are showing the magnetic fields around three current carrying conductors. The symbolism indicates that the current in P is into the page, that the current in Q is out of the page as is that in R (right hand grip rule). The closeness of the field lines indicates that $I_P > I_R > I_Q$. Only those around R have been drawn correctly – becoming further apart further from the conductor. The other two sets have been drawn equidistant and do not reflect the weakening field further from the conductors.

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